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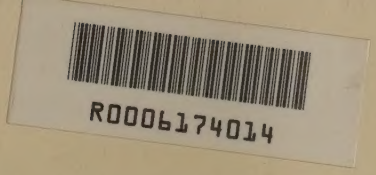
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THE HARDWOODS OF AUSTRALIA AND THEIR ECONOMICS.

To

His Excellency

Sir RONALD C. MUNRO FERGUSON,

P.C., G.C.M.G.,

GOVERNOR-GENERAL OF AUSTRALIA.

As an appreciation of the keen interest which His Excellency (by the application of his European knowledge of, and wide experience in, Sylviculture) has displayed in promoting the advancement of Australian Forestry during the

period of

His Governor-Generalship

over

This Island Continent

of the British Empire,

This work is

Dedicated.

DEPARTMENT OF EDUCATION.

NEW SOUTH WALES.

Minister:

THE HON. A. G. F. JAMES, M.L.A., B.A., BARRISTER-AT-LAW.

Under Secretary and Director of Education:

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Superintendent of Technical Education:

JAMES NANGLE, ESQ., F.R.A.S.

AUSTRALIAN HARDWOODS USED IN THE LAUNCHING CEREMONY:

CASKET: Stringybark, *Eucalyptus obliqua.*
MALLET: Myall, *Acacia pendula.*
CHISEL HANDLE: Murray River Red Gum, *E. rostrata.*

TECHNICAL EDUCATION SERIES, No. 23.

DEPARTMENT OF EDUCATION.

TECHNICAL EDUCATION BRANCH.

Technological Museum, New South Wales.

THE HARDWOODS OF AUSTRALIA AND THEIR ECONOMICS.

BY

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"Pines of Australia," &c.

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1919.

PREFACE.

THE object of this work is primarily to arouse a keener interest in, and to make known to Australians in particular and the world in general, the diversity of hardwoods with which nature has endowed this wonderful Continent.

Especially is it written for the technologist in wood—the Architect, Builder, Saw-miller, Engineer, Cabinet-maker, and, not least by any means, the Forester, for it rests with him whether the species producing these valuable hardwoods will become extinct and so pass down to coming generations as a name only, or be progagated for the use of mankind in future. He holds the destiny of these remarkable timbers in his hands, and posterity will measure his degree of efficiency by the amount of success attending his efforts to prevent such a magnificent and valuable national asset from passing into the limbo of oblivion.

Probably not less than nine-tenths of the trees of our forests are hardwoods, and these are, by nature's selection, products of our soil, and such a predominance should be a weighty factor in their propagation. Nor should this natural selection be ignored in any scheme for their extermination in order to plant exotic trees.

One Forestry problem to be faced by Australia is Hardwoods *versus* Softwoods. Nature has selected *hardwoods* and so man's choice would not go far wrong by following such a preceptor. Not that I do not advocate the planting of softwoods, far from that, but they should, I think, be restricted to areas where our hardwoods do not flourish.

As near as possible the botanical systematic arrangement follows on the lines of that of the English botanists, Bentham and Hooker, and for obvious reasons these war times. With few exceptions only those species actually yielding a good hardwood are enumerated.

The method of treatment of the subject is not based on that of any previously published book on the subject as far as I know. Part I is written more especially for the Student; Part II for the Student, the Commercial man, and the Technologist; Part III more particularly for the two last mentioned.

It is hoped that this will meet their desiderata in this connection, in which case this effort will achieve its object, viz., to move the Australian to appreciate more than ever his native timbers.

It is sincerely wished that this contribution to a knowledge of so valuable a natural resource will be conducive to a much larger appreciation of our forest products in the future than has held in the past, for it is doubtful if any group of trees yield so great a diversity of economics as our Australian Hardwoods.

May, 1919. R.T.B.

57274

INTRODUCTION.

THE title of the book might, perhaps, lead one to infer that possibly another important section of our timbers, viz., Softwoods, figure largely under the whole subject of Australian timbers, but as shown later such is not the case, in fact, the softwoods form such a comparatively small proportion of our forests that one is quite safe in saying that the prevailing feature of our woods is their hardness.

For so vast a Continent it is remarkable that the number of species of trees is not by any means great, particularly when compared with some of the Pacific group of Islands, such as the Philippines, where, according to Major E. P. Ahern, "there are found more than 2,000 tree species," while the United States and Canada have less than 700. From a rough computation Australia has probably less than 500. This does not mean a scarcity of timber, for there is no deficiency, as the individual species range over great areas of country. To give only a few instances:—Murray Red Gum, *Eucalyptus rostrata*, extends over the interior of New South Wales, Victoria, South Australia, and Queensland. The Stringybark, *E. obliqua*, has a wide distribution in Tasmania, Victoria, South Australia, New South Wales, and Queensland. Again, genera containing large numbers of tree species are very few; the genus however, which stands out in great predominance as a timber yielder is Eucalyptus, and exceeds all others put together. These are the trees which are so conspicuous in the landscape of nearly the whole Continent, the exception being the Brushes of the East Coast, and Coast ranges of Queensland.

The described species of Eucalyptus probably number two hundred, and in these are to be found a great variety of timbers, perhaps greater than that of any other genus in the world, and what is of more commercial importance most of the trees are timber yielding, the exception being the Mallees (small whip stick stems a few feet high), and only a very few of these have little industrial value. The few poor timber species, as well as the Mallees, even at the lowest estimate, can be used for firewood or charcoal.

Therefore in view of the enormous extent of area covered by the Eucalyptus alone, Australia has propably the largest variety of hardwoods in the world, as they must cover hundreds of thousands of square miles.

In the Coastal Brushes there are also some fine specimens of hardwoods, such as Teak, *Flindersia australis*, Red Ash, *Alphitonia excelsa*, and many others.

Then again there is that large class of Acacias, which yield in a few cases some of the hardest of woods such as Myall, *A. pendula*, and several others specified under the genus. Casuarinas also yield some of the hardest timbers.

Our Eucalypts being almost ubiquitous on the Continent naturally supply the bulk of our hardwood desiderata and it will therefore be noted that they occupy in description, colour and anatomy of timber the largest portion of this work.

These timbers present some difficulty in specific determination in the respective groups in which they are placed, but as several of each group are reproduced in colour it is hoped this difficulty will be obviated in some degree to those interested in their systematic nomenclature and identification.

Much specific assistance in this direction was expected from the structural characteristics of these timbers, but the results were rather disappointing, and almost the same thing held as regards the barks, whilst the groups are readily differentiated, although not so easily the species.

In most families of plants the arrangement of cells, fibres, and vessels in the stem of a tree is co-ordinated with those characteristics which determine its position in the systematic sequence, such as Silky Oak, but this does not apply to the Gum trees, for a comparative uniformity of arrangement and structure runs through the whole genus.

As all Eucalyptus timbers are valued for their hardness and weight, features due to the predominance of fibres and the thickness of their walls, it was found that specific variation was due in some cases to a varying thickness of the fibre walls, the parenchyma, the cell and vessel content; for in the case of Ironbarks the lumen is so very limited in diameter that the walls occupied nearly the whole area of the diameter. Then again, that lighter portion—the thin walled structure, wood parenchyma, forms a limited portion of the wood mass. Tracheids apparently are mostly absent in these woods, another contributing factor to their hardness.

Rays are much more numerous than would be suspected by a macroscopical examination of the wood, and this feature is well seen in the microscopic sections given under several species. The figure so common amongst Eucalyptus timbers is not due to the prominent rays as in Oaks, but to the fibres and wood elements running in waves, or undulations.

In the case of red timbers the ray cells are found to be filled with a coloured substance, which, together with that in the cell walls, gives this wood element a brick wall appearance, and in a radial section, often when the supporting medium is cut away, it looks (under a lens) like a number of bricks falling down from a wall. This substance also occurs in the parenchyma, and sometimes in the fibre cells, and it is this which gives the red colour to the timbers.

In the Eucalypts of Western Australia the wood parenchyma cells are sometimes wholly filled with this secretion, and in the fibre cells appears as a red thread when free from the lumen. In the extremely hard woods of the genus the vessels were almost entirely blocked by tyloses.

The controversial subject of nomenclature of our hardwoods, especially the Eucalypts, is treated in a special article, as it is a subject which requires serious consideration from a commercial standpoint for all interested in this valuable national asset.

In one respect these timbers have a considerable advantage over most other exotic hardwoods, namely, their rapidity of growth, and this is well illustrated by Mr. A. J. McClatchie, M.A., in his book " Eucalypts cultivated in the U.S. of America," where is shown in Plate XXII an English Oak and an Australian Gum tree, the former being 200 years old, and the latter, whilst only 24 years standing, has made more hardwood in that space of time than the Oak in 200 years, and ours will grow just as quickly here. With such a magnificent asset of rapid growing trees Australia's rôle in the timber market of the world should be easily first in hardwoods, for no finer or quicker-growing hardwood-yielding trees are to be found anywhere.

And what is of still greater value is their diversity of hardness and colour so that almost any branch of Technology can be served by the timber of these trees, and almost every day new avenues of utilisation are being exploited.

Such qualities as characterise exotic timbers can generally be found in either one or other species of our hardwoods, so that there is really very little necessity to import hardwoods, or at least only in special and very limited cases.

Reafforestation of our fast disappearing varieties of timber should be the watchword of every Australian.

For the resuscitation of Forestry here, New South Wales will ever be indebted to the insistent efforts of the Hon. W. G. Ashford, M.L.A., Minister for Lands and Forests, for his great work in the cause of Sylviculture.

Forestry to-day in Australia stands in a very favourable position as regards the economics of individual species, for much research has been undertaken on their Technology so that the commercial value of the more important at least is known, and thus there would be no waiting for the results of the research laboratory before commencing to replant.

Generous nature has given us a good soil and a perfect tree climate over a vast extent of country, and the duty therefore devolves upon Australians to show their appreciation of these gifts by entering upon and carrying out to a successful issue a vigorous system of reafforestation.

Many woods are illustrated which are only occasionally on the market, and this has been done intentionally in order to show what a great variety of hardwoods are to-day growing in Australia, and especially to bring them under the notice of this and other State Forestry Departments, so that these remarkable timbers may figure largely in future systems of Sylviculture before the species are finally exterminated.

For these to be allowed to pass away without any attempt at their propagation would be bordering almost on criminality, for not many countries can boast of such a wonderful natural heritage as our marvellous hardwoods.

May, 1919. R.T.B.

ACKNOWLEDGMENTS.

NATURALLY in a work of this description and scope, I have had to seek the help of others interested in the subject of our hardwoods, and my indebtedness is mostly acknowledged in the letterpress, where the information is recorded.

In addition to those so mentioned, I have also to acknowledge the assistance rendered by Mr. D. Ellerton Brown, Huon Timber Company, Tasmania; Mr. A. J. Crowther, Secretary for Railways, Queensland; Mr. G. Dent, Husskinson, Jervis Bay; Electric Light and Power Supply Corporation, Balmain; Mr. C. S. Grahame, B.Sc., Brisbane; Harbour Trust of Sydney; Mr. F. P. Jones, Railway Workshops, Newport, Victoria; Marine Board, Hobart; Mr. J. C. Penny, Chief Forestry Office, Hobart; Mr. C. E. Lane-Poole, Conservator of Forests, Western Australia; Mr. V. H. Ryan, Tourist Bureau, Adelaide; Mr. W. Shannon, Chief Mechanical Engineer, Melbourne; Mr. W. T. Simpson, North Melbourne; Sydney Municipal Council; Messrs. Allen Taylor & Co., Timber Merchants, Sydney; Mr. G. A. Taylor, Editor of "Building"; Mr. C. T. White, Government Botanist, Brisbane; and Mr. R. M. Winstanly, Council Chambers, Melbourne.

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My best thanks are also due to the Government Printer, Mr. W. A. Gullick, and the several members of his staff, from whom I received much assistance and many suggestions during the time the book was passing through their hands.

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HARDWOODS OF AUSTRALIA.

GENERAL.

The characteristic feature of Australian trees is, that by far the majority produce a hardwood,—soft woods forming only a comparatively small proportion.

In a Continent so large as Australia with an area of over 3,000,000 square miles one would naturally expect to find a great variety of Genera and species of timber trees, but such is hardly the case. The Natural Orders producing timbers are by no means numerous for so great a division of the earth's surface; the Myrtaceæ and Leguminosæ far outnumber the others in species, and the area of land over which these extend, especially the former, leaves only a limited portion for the remaining families of timber trees, and this is mostly coastal brushes.

Of all the Australian Genera the genus *Eucalyptus* probably covers at least two-thirds of the whole surface and it is these trees that supply the bulk of the hardwoods of the timber trade both at home and abroad. Although these woods must be classified under the headings of hardwoods, yet they possess great differences in physical properties for timbers of a single Genus, and probably more so than that of any other known Genus. It is these features that give them such a high reputation in the commercial world and make them of so much value to the various trades.

One of their greatest values is their rapidity of growth,—a Eucalyptus tree will attain greater dimensions in 24 years than an Oak tree (*Quercus*) in 200 years.

The range of qualities of our hardwoods is such that a good substitute can be found amongst them for almost any exotic timber in colour, grain, weight, texture, durability, or other properties, and hence we find that almost every avenue and calling in the timber trade can be supplied by our hardwoods as will be seen by the references under the articles giving their uses.

The line of demarcation between a "hard-" and "soft-" wood is rather vague as it is not based on figures, for many a wood is easily worked with a chisel and saw and is yet classed as hard, whilst another kind will offer great resistance to cutting tools.

At the same time it is not always easy to differentiate between various kinds of wood by their degree of hardness; thus we find in practice a timber is classified as hard and yet on a mechanical test would only pass as a softwood, and this latter fact has raised difficulties in several cases, as to whether or not a species should be included as a "hardwood" in this work, for instance—*Ceratopetalum apetalum*, or the reverse as *Banksia serrata*, and some of the Callitris species,—generally regarded as a softwood, yet under the test rank as a hardwood.

It will be noted that under the species this feature of the timber is given as either moderate, hard, very hard, or extremely hard, results which were obtained by (1) dropping a weight from a certain height with a steel tool attached and measuring the depth of the impression made on the piece of wood; as impact was found to be the best test for hardness,—and (2) practical trade tests.

Two typical softwoods may be mentioned for comparison, viz., *Cedrela Toona* Roxb., Red Cedar, and *Elæocarpus grandis*, F.v.M., Blue Fig, which gave an impression under this test about twice the depth of the moderately hard woods, shown in the illustration.

TYPES OF HARDNESS.

FIG I.

T. C. Roughley, Photo.]

1 EXTREMELY HARD. 2 VERY HARD. 3 HARD. 4 MODERATELY HARD. 5

1. GIDGEA, *Acacia Cambagei*. 2. IRONBARK, *Eucalyptus crebra*. 3. MURRAY RED GUM, *E. rostrata*. 4. MOUNTAIN ASH or TASMANIAN OAK, *E. Delegatensis*. 5. JARRAH, *E. marginata*.

It might be added that hardness and strength as also elasticity of a timber are different qualities. Thus *E. Delegatensis* according to this scale belongs to the moderately hard timbers, but yet furnishes a wood which is elastic, solid, and also durable. Then again, a timber may be classed as soft but yet be tough and strong, as *Orites excelsa* and *Grevillea robusta*, or light in weight and strong, and so have good claims to be ranked as a hardwood, as *Flindersia Schottiana*. Thus the term "hardwood" must be taken in a broad sense and not arbitrarily. It has, however, come into the trade and so cannot now be discarded, but no one word seems to appropriately express all the qualities intended by the commercial man to cover the name "hardwood."

A list of timbers in sequence of hardness is given in Part III.

PART I.

PHYSICAL PROPERTIES OF TIMBERS.

I. COLOUR.

This character is without doubt one of the greatest aids in the systematic diagnosis of a timber, as the individual colour will alone often determine the specific identification. The value of this feature in this connection is of considerable importance.

Most timbers may be said to be marked by two distinct colours or tints, viz., that of the heartwood and the sapwood, the latter being almost colourless or of the palest tint.

It is the heartwood or secondary wood that carries the distinguishing colour of a timber, which is due to the presence in the vessels, parenchyma cell walls, lumen of the fibres, fibre walls or even the partition substance surrounding the fibres, of some such material as manganese compounds, alumina compounds, &c., tannin, pigments, dyes, oils, and many other chemical constituents.

Familiarity with timbers accustoms one to recognise their distinctive colour, but at the same time it is often difficult to describe that colour.

This property of timber, whilst far from ranging through the whole gamut of primary and secondary colours, is more or less restricted to such well known tints as red, brown, and yellow, and between these will be found such numerous gradations as to be almost indefinable, hence the timber expert's trouble is the difficulty of expressing these colours in descriptive language.

Mostly it is immaterial in constructional works what the colour is, but it is of value in, say, flooring, or whenever hardwoods are requisitioned by the cabinet-maker. Again in certain specific cases, as in some red Eucalypts, it has a distinct commercial value for cabinet work, just as in other woods, hard or soft.

The colours described and figured in this book are those of a newly planed surface, as it was thought that this would give a colour truer to nature than a surface which has been exposed for any length of time, when it is found that the colour considerably deepens or changes altogether, probably due to the oxidation of the colouring matter. Two of the best instances in this respect are *Zanthoxylum brachyacanthum*, the Thorny Yellow-wood, and *Alphitonia excelsa*, Red Ash; the former being of a bright canary colour when freshly cut, which disappears (unless polished or varnished) in two or three years, whilst the latter is a pale colour when first planed, but changes to a nice fresh red on exposure.

Colour, however, is not always a test of durability, but sometimes the reverse, for a bluish, black, or oftener a yellow discolouration is known in the trade as "Dosey," and is an indication of the decaying of the tissues due to the presence of a fungus.

Great care in identification is, however, necessary when the common name carries a colour implication, since, in some cases it is altogether very misleading and sometimes inappropriate as regards timber, as for instance the use of the name Blue Gum. First let it be said here that the wood is never blue, in fact, this name is applied to trees with timbers almost ranging through the whole colours found in Eucalypts. The world famed Blue Gum of Tasmania has a pale coloured timber, whilst the Sydney Blue Gum is from pink to bright red. Again, Yellow Box is not so named from its timber, but the yellow inner surface of the bark.

White Ironbark is so called on account of its almost white timber (when freshly cut), but the wood is hardly white and is only pale in contrast to Grey and Red Ironbark which receive their names in allusion to their timber colour.

Then on the other hand we have terms which faithfully describe the colour of the wood, thus, Red Mahogany, *E. resinifera*, has a red timber, and White Mahogany, *E. acmenioides* and *E. umbra*, have white or pale timbers. Red Ash, *Alphitonia excelsa*, has a beautiful red coloured timber, whilst Forest Red Gum, Murray Red Gum, Grey Box, Red and White Mahogany, are names which correctly describe the colour of the wood.

Also in the case of similar names as Red Cedar, Red Bean, and Yellow Cedar, it will be found that these quite express the colour of the timber. As stated above, most timbers have two very distinct colours, each restricted to the sapwood and heartwood, the former occurring immediately beneath the bark and occupying only a limited space in the whole wood area, and distinguished by its pale colour.

Some timbers, however, have their larger portion marked by this pale colour and one would naturally think that this was wholly sapwood, but such is not often the case, as it is just as hard and durable as the darker part, and only the outer part near the Cambium is the true sapwood. There are some good examples of this in Australian timbers, as for instance *Aphitonia excelsa*, Red Ash, and *Tristania laurina*, Water Gum, as shown in the coloured plates.

Again, some timbers have one colour throughout and show no demarcation of sapwood and heartwood, such as the Pittosporeæ, Rutaceæ, Sapindaceæ, Euphorbiaceæ.

The following colour classification may be of assistance in the identification of our hardwood timbers; and types of each are given in the coloured plates:—

(1) Dark Red.
(2) Red.
(3) Pink.
(4) Grey.
(5) Chocolate.
(6) Yellow.
(7) Pale.
(8) White.

TIMBER COLOURS.

1. DARK-RED.—

Banksia serrata, Linn.	... Red Honeysuckle.
Cadellia pentastylis, F.v.M. ...	... Red-wood.
Casuarina Luehmanni, R.T.B. ...	... Bull Oak.
C. torulosa, Ait.	... Forest Oak.
Eucalyptus affinis, H.D. et J.H.M.	... Black Box, Ironbark Box.
E. Cambageana, J.H.M.	...
E. Dawsoni, R.T.B. ...	... Slaty Gum.
E. Fergusoni, R.T.B. ...	... Dark-red Ironbark.
E. longicornis, F.v.M. ...	... Morrell.
E. marginata, Sm. ...	... Jarrah.
E. microtheca, F.v.M.	... Coolabah or Swamp Box.
E. polyanthema, Schauer	... A Red Box.
E. punctata, DC. ...	... A Grey Gum.
E. redunca, Sch. ...	... Wandoo.
E. resinifera, Sm. ...	... Red Mahogany.
E. rostrata, Schlecht ...	... Murray River Red Gum.
E. salmonophloia, F.v.M.	... Salmon Gum.
E. siderophloia, Benth.	... Broad-leaved Ironbark (Red).
E. squamosa, H.D. et J.H.M.	... Scaly-barked Red Gum.
Grevillea Hilliana, F.v.M. ...	... Red Silky Oak.
G. striata, R.Br.	... Beef-wood.
Hakea leucoptera, R.Br.	... Needlewood.
Syncarpia laurifolia, Ten. ...	... Turpentine.
S. leptopetala, F.v.M. ...	... Brush Turpentine.
Tristania neriifolia, R.Br. ...	... Narrow-leaved Water Gum.
T. suaveolens, Sm. ...	... Swamp Turpentine.
Ventilago viminalis, Hook. ...	... Supple Jack.
*Xylomelum pyriforme, Sm. ...	... Native Pear.
*X. occidentale, R.Br.	do (Western Australia).

2. RED. –

Acacia penninervis, Sieb. ...	... Mountain Hickory.
Alphitonia excelsa, Reiss. ...	... Red Ash.
Eucalyptus botryoides, Sm. ...	... Bangalay, A Mahogany.
E. cornuta, Labill. ...	... Yate.
E. crebra, F.v.M. ...	... Narrow-leaved Red Ironbark.
E. Deanei, J.H.M. ...	... A Blue Gum.
E. diversicolor, F.v.M. ...	... Karri.
E. Griffithii, J.H.M. ...	...
E. hemilampra, F.v.M.	... A Mahogany.
E. intermedia, R.T.B.	... A Pale Bloodwood.
E. longifolia, Link and Otto	... Woolly-butt.
E. melanophloia, F.v.M.	... Silver-leaved Ironbark.
E Nanglei, R.T.B. ...	... Pink Ironbark.
E. patentinervis, R.T.B.	... A Mahogany.
E. propinqua, H.D. et H.J.M.	... A Grey Gum (Small-fruited).
E. populifolia, Hook. ...	... Poplar-leaved Box.
E. robusta, Sm. ...	... Swamp Mahogany.
E. saligna, Sm. ...	... Sydney Blue Gum.
E. tereticornis, Sm.	... Forest Red Gum.
Eugenia jambolana, Lam. ...	... Duroby.
Stenocarpus salignus, R.Br. ...	... Beef-wood.

3. PINK.—

Banksia verticillata, R.Br. ...	... River Banksia.
B. integrifolia, Linn. ...	... White Honeysuckle.
B. marginata, Cav. ...	... Honeysuckle.
*Cardwellia sublimis, F.v.M. ...	... Bull Silky Oak.
Casuarina Fraseriana, Miq. ...	... She Oak.
*Ceratopetalum apetalum, D.Don.	... Coachwood.
Cupania semiglauca, F.v.M. ...	... Wild Quince.
C. tenax, A.Cunn.	... Brush Teak.
Elæodendron australe, Vent. ...	... Blue Ash.
*Embothrium Wickhami, F.v.M. ...	... Satin Silky Oak.
Endiandra discolor, Benth. ...	... Murrogun.
E. Sieberi, Nees. ...	... Corkwood.
E virens, F.v.M. ...	... Swamp Rosewood.

3. PINK—*continued.*

Eucalyptus Benthami, J.H.M.	
E. bicolor, A.Cunn.	Flooded Box.
E. Jacksoni, J.H.M.	
E. Laseroni, R.T.B. & H.G.S....	New England Stringybark.
E. macrorhyncha, F.v.M. ...	Red Stringybark.
E. Macarthuri, H.D. et J.H.M.	Camden Woolly-butt.
E. rubida, H.D. et J.H.M. ...	Candle Bark or River Box.
E. viminalis, Labill.	Ribbony Gum. Manna Gum.
Eucryphia Billardieri, Spach	
*E. Moorei, F.v.M.	Plum wood.
Eugenia Coolminiana, C. Moore	Coolamon.
Exocarpus cupressiformis, Labill. ...	Native Cherry.
*Fagus Cunninghamii, Hook.	Tasmanian Myrtle.
F. Moorei, F.v.M.	Negro-head Beech.
Flindersia Chatawaiana, Bail.	Queensland Maple.
*F. Brayleyana	Silk Wood.
*Grevillea robusta, A.Cunn.	Silky Oak.
Hakea saligna, R.Br.	Foley-wood.
Melaleuca Maideni, R.T.B.	Bellbowrie Tea-tree.
M. Smithii, R.T.B.	Broad-leaved Tea-tree.
Monotoca elliptica, R.Br.	Pigeon Berry.
Nephelium leiocarpum, F.v.M.	
N. tomentosum	
Olea paniculata, R.Br.	Clove Berry or Marble-wood (yellow in centre).
*Orites excelsa, R.Br.	Silky Oak or Prickly Ash.
Telopea oreades, F.v.M.	Victorian Waratah.
Tristania laurina, R.Br.	River Box, Water Gum, or Tea-tree (Dark-red heart-wood).
T. conferta, R.Br.	Brush Box.
Vitex lignum-vitæ, A.Cunn.	Lignum vitæ or Black Satin-wood.
*Weinmannia Benthami, F.v.M. ...	Red Carabeen.
W. lachnocarpa, F.v.M. ...	Marane.

4. GREY.—

Angophora lanceolata, Cav.	Smooth-barked Apple.
Backhousia myrtifolia, Hk. & Harv. ...	Grey Myrtle.
B. sciadophora, F.v.M. ...	Myrtle.
Bridelia exaltata, F.v.M.	Brush Ironbark.
Casuarina glauca, Sieb.	Swamp Oak (Dark-red heart-wood).
C. suberosa, Ott. & Dietr. ...	She Oak.
Cupania nervosa, F.v.M.	Beetroot.
C. pseudorhus, A.Rich.	Iccaaya or Fern Tree.
Diospyros pentamera, F.v.M.	Grey Plum, Black Myrtle.
Endiandra globosa, Maiden & Betche ...	Large Black Apple.
Eucalyptus calophylla, R.Br.	Red Gum.
E. maculata, Hook.	Spotted Gum.
E. paniculata, Sm.	Grey Ironbark.
Eugenia Ventenatii, Benth.	Drooping Myrtle, Swamp Elm.
Hemicyclia australasica, Muell. & Arg....	Yellow Tulip.
Rhodamnia argentea, Benth.	Silver Myrtle.
Santalum cygnorum, Miq.	Sandalwood.
Tarrietia actinophylla, Bail.	Ironwood.

5. CHOCOLATE.—

Acacia acuminata, Benth.	Raspberry Jam.
A. aulacocarpa, A.Cunn.	Brush Ironbark.
A. excelsa, Benth.	Ironwood.
A. harpophylla, F.v.M.	Brigalow.
A. homalophylla, A.Cunn.	Yarran.
A. melanoxylon, R.Br.	Blackwood.
A. pendula, A.Cunn	Myall.
A. salicina, Lindl.	Eumung.
Bridelia exaltata, F.v.M.	Brush Ironbark.
Castanospermum australe, A.Cunn. ...	Black-bean or Morton Bay Chestnut.
Castanospora Alphandi, F.v.M.	
Casuarina Cambagei, R.T.B.	Belah.
Cryptocarya Palmerstoni, Bail.	Queensland Walnut.
Cupania anacardioides, A.Rich.	Carrot-wood.
Eremophila Mitchelli, Benth.	Budda or Sandalwood.
Eucalyptus Beyeri, R.T.B.	Dark-brown Ironbark.
E. Clelandi, J.H.M.	
E. Le Souefii, J.H.M.	
E. loxophleba, Benth. ...	York Gum.
E. tesselaris, F.v.M.	Carbeen.

5. CHOCOLATE—*continued.*

Harpullia pendula, Planch. ...	... Tulip-wood.
Macadamia ternifolia, F.v.M. ...	... Queensland Nut or Bush Nut.
Melaleuca styphelioides, Sm. ...	... Prickly-leaved Tea-tree.
Petalostigma quadriloculare, F.v.M.	... Bitter Bark or Wild Quince.
Phyllanthus Ferdinandi, Muell. & Arg.	... Water Gum.
P. F. var. supra-axillaris	
Ratonia stipitata, Benth. ...	...
Scolopia Brownii, F.v.M. ...	... Mountain Cherry.
Tarrietia argyrodendron, Benth. ...	... Crow's-foot Elm.

6. YELLOW.—

Bosistoa euodiformis, F.v.M. ...	...
B. sapindiformis, F.v.M. ...	... Union Nut.
Bursaria spinosa, Cav.	... Box Thorn or Black Thorn.
Cadellia monostylis, Benth. ...	... Black Plum (Brown heart-wood).
Daphnandra micantha, Benth. ...	... Yellow-wood, Satin-wood, Butter-wood.
Emmenospermum aphitonioides, F.v.M.	Bone-wood.
Eucalpytus Fletcheri, R.T.B. ...	... Lignum Vitæ, Box.
E. globulus, Labill. ...	... Blue Gum (Tas.), Eurabbie.
E. gomphocephala, DC.	... Tuart.
E. goniocalyx, F.v.M. ...	... Mountain Gum.
E. hemiphloia, F.v.M.	... Grey Box.
E. microcorys, F.v.M. ...	... Tallow-wood.
E. Muelleriana, How. ...	... Victorian Yellow Stringybark.
E. patens, Benth. ...	... Blackbutt.
Excæcaria Dallachyana, Bail. ...	...
Flindersia australis, R.Br. ...	... Teak (Crow's Ash, Queensland).
F. maculosa, F.v.M. ...	... Leopard-wood.
F. Oxleyana, F.v.M. ...	... Long Jack or Yellow-wood.
F. Schottiana, F.v.M. ...	... Cudgerie.
F. Iffiaiana, F.v.M. ...	... Cairn's Hickory.
Geijera Muelleri, Benth.	... Axe Breaker.
G. salicifolia, Schott. ...	... Lignum Vitæ, Ironwood.
G. parviflora, Lindl. ...	... Wilga.
Halfordia drupifera, F.v.M. ...	... Boogoogin.
H. scleroxyla, F.v.M. ...	...
Hymenosperum flavum, F.v.M.	... Wollum Wollum.
Medicosma Cunninghamii, Hook.	... Glue Gum or Scrub Bloodwood (Choc. heart-wood).
Pennantia Cunninghamii, Miers.	...
Pentaceras australis, J. Hooker ...	... Scrub Hickory.
Polyosma Cunninghamii, J. J. Benn.	... Feather-wood.
Rhodosphæra rhodanthema, F.v.M.	... Yellow Cedar.
Sideroxylon australis, Benth. et Hook	... Black Apple.
S. obovata, F.v.M. ...	... Snoddy Apple (Chocolate heart-wood).
S. Pholmaniana, F.v.M.	... Black Apple.
Symplocos spicata, Roxb. ...	... Doura.
Zanthoxylum brachyacanthum, F.v.M.	... Thorny Yellow-wood.

7. PALE.—

Angophora intermedia, DC. ...	... Rough barked, or Narrow-leaved Apple.
A. subvelutina, F.v.M. ...	... Rough-barked or Broad-leaved Apple.
Avicennia officinalis, Linn. ...	... Grey mangrove.
Beilschmiedia obtusifolia, Benth.	... Pomatum-wood.
Casuarina Cunninghamii, Miq. ...	... River Oak (Chocolate heart-wood).
Celtis paniculata, Planch. ...	... Tripe-wood.
Claoxylon australe, Bail.	...
Cupania tomentella, Linn. ...	... Bungarie.
Diploglottis Cunninghamii, Hook.	... Native Tamarind (Dark heart-wood).
Eucalyptus acervula, Hook. ...	... Red Gum (Tasmania).
E. acmenioides, Schauer.	... White Mahogany.
E. albens, Miq.	... White Box.
E. amygdalina, Labill. ...	... Narrow-leaved Peppermint or Messmate.
E. angophoroides, R.T.B.	... Apple-topped Box.
E. Australiana, R.T.B. et H.G.S.	Messmate.
E. Banksia, J.H.M. ...	...
E. Bosistoana, F.v.M. ...	... South Coast Red Box.
E. Brownei, Maiden & Cambage	Box.
E. campanulata, R.T.B. et H.G.S.	A Stringybark or New England Peppermint.
E. Cannoni, R.T.B. ...	... Red Stringybark.
E. capitellata, Sm. ...	... Brown Stringybark.
E. carnea, R.T.B. ...	... A Stringybark.
E. Delegatensis, R.T.B.	... Southern Mountain Ash.
E. dextropinea, R.T.B.	... A Stringybark.

ALE.—*continued.*

Eucalyptus eugenioides, Sieb.	White Stringybark.
E. fastigata, H.D. et J.H.M. ...	Cut-tail.
E. Guilfoylei, J.H.M.	
E. Jacksoni, J.H.M.	
E. lævopinea, R.T.B.	Silver-top Stringybark.
E. leucoxylon, F.v.M.	South Australian Blue Gum or Ironbark.
E. Muelleri, F. B. Moore ...	Brown Gum.
E. Maideni, F.v.M.	Southern Blue Gum, A Spotted Gum.
E. melliodora, A.Cunn. ...	Yellow Box.
E. Mundijongensis, J.H.M. ...	
E. oreades, R.T.B. ...	Smooth-barked Mountain Ash.
E. pilularis, Sm.	Black-butt.
E. piperita, Sm.	Sydney Peppermint.
E. Planchoniana, F.v.M. ...	A Tallow-wood.
E. quadrangulata, Deane and Maiden.	A Grey Box.
E. Rodwayi, R.T.B. & H.G.S.	Black Gum (Tasmania).
E. scoparia, J.H.M.	
E. Sieberiana, F.v.M.	Mountain Ash.
E. umbra, R.T.B.	A White Mahogany. A Stringybark.
E. virgata, Sieb.	Tasmanian Ironbark.
E. Wilkinsoniana, R.T.B. ...	Small-leaved Stringybark.
Eugenia Smithii, Poir.	Lilly Pilly.
E. brachyandra, Maiden & Betche	Red Apple.
Litsea dealbata, Nees.	
Maba fasciculosa, F.v.M.	
Villaresia Moorei, F.v.M.	N.S.W. Maple.

8. WHITE.—

Aphananthe Philippinensis, Planch. ...	Native Elm or Australian Hickory.
Citriobatus lancifolia, Bail.	
Croton phebalioides, F.v.M.	
C. verreauxii, Bail.	
Cryptocarya obovata, R.Br.	Mucam.
C. triplinervis, R.Br. ...	
C. microneura, Meissn.	
Eucalyptus Dunnii, J.H M.	
E. fraxinoides, H.D. & J.H.M.	White Ash.
E. nitens, J,H.M.	
E. regnans, F.v.M.	Giant Gum.
*Evodia accedens, Blume	
E. erythrococca, Benth.	Soap-wood.
E. micrococca, F.v.M.	White-wood.
E. octandra, F.v.M.	Soap-wood.
Flindersia Bennettiana, F.v.M.	White Cudgery or She Teak.
Helicia glabriflora, F.v.M.	
H. prœalta, F.v.M.	Possum Nut.
Mallotus claoxyloides, J. Muell.	
M. Philippinensis, Muell. & Arg. ...	
Nephelium foveolatum, F.v.M.	
Notelæa ligustrina, Vent.	Ironwood or Silk-wood.
Pittosporum rhombifolium, A. Cunn. ...	White Holly.
P. bicolor, Hook.	Cheese-wood.
Pseudomorus Brunoniana, Bureau ...	Whale-bone Tree.
Siphonodon australe, Benth.	Native Guava or Ivory-wood.
Stenocarpus sinuatus, Endl.	Fire Tree.

* Softwoods.

II. GRAIN, FIGURE, AND TEXTURE.

These terms are often applied indiscriminately in the timber industry when describing certain features of our timbers, no regard being given to the true sense in which they should be used.

They, however, are capable of specific meaning, if used correctly, for in the case of the first two, they refer to the disposition of the wood elements, whereas in the case of "texture" it is the physical characters of the various parts or organs which compose the wood structure that is meant.

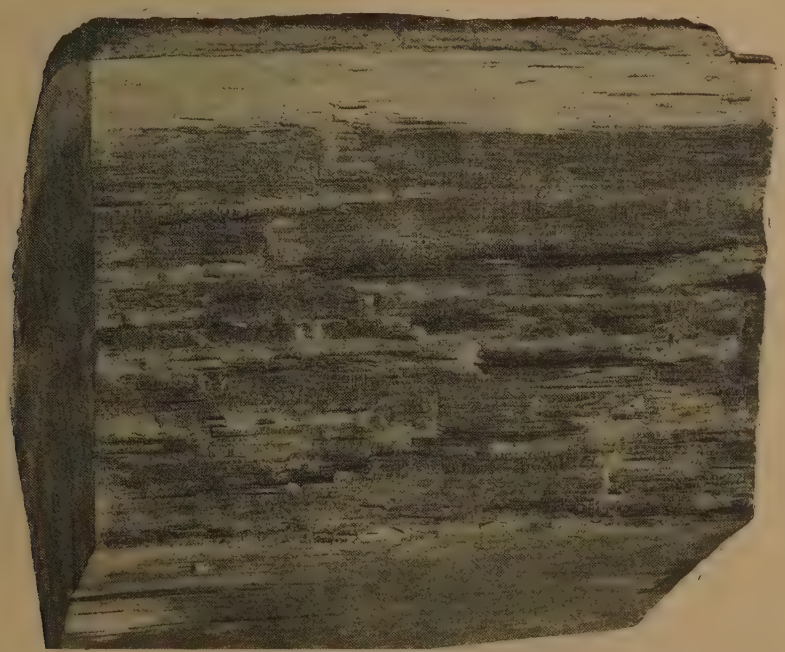
GRAIN.

It is common to find that artisans in the various wood trades when speaking of the grain of a timber will describe it as either (*a*) straight, (*b*) open, (*c*) close, (*d*) interlocked, (*e*) short, (*f*) wavy, or (*g*) silver grain, but not always does the same interpretation hold in each case.

(*a*) Straight Grain.

Now a microscopical examination of a piece of timber coming under this designation shows that the wood parenchyma, vessels, and fibres especially, are all running parallel and straight with each other,—that is, in the long axis of the tree. Such a hardwood timber is fissile, and planes up easily with a smooth surface, *i.e.*, without tearing. This feature is more common amongst softwoods, such as Pines, with their tracheids, than hardwoods, but *E. regnans* and *E. fraxinoides* are good examples of the latter. These elements can easily be seen in the micro-timber slides reproduced in this book. *See also Plates* 7, 8, 12, 20, 57, 71, 91, 92.

Fig. II.



STRAIGHT-GRAINED TIMBER.
Jarrah, *Eucalyptus marginata.*

(*b*) Open Grained.

In the open-grained wood the last two elements predominate with larger channels and cell diameters and the fibres have thinner walls than those of close-grained timbers. Soft woods are better illustrations of this character, but *Eucalyptus corymbosa*, *E. regnans*, *E. Delegatensis*, *Banksia serrata*, *Acacia Bakeri* are good illustrations amongst hardwoods. *See also Plates* 34, 71, 91.

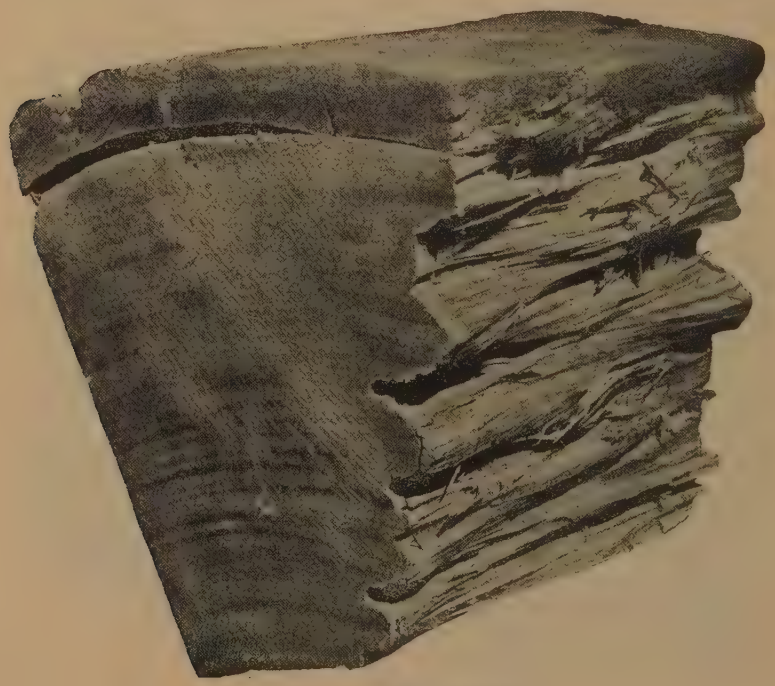
(*c*) Close Grain.

In a similar examination *(a)* of a piece of wood to which this term is applied it will be found that the fibres are thick walled, closely packed, and form the bulk of the wood over the proportion of the parenchyma and vessels, which have comparatively small cells and channels respectively,—*Scolopia Brownii*, *Pittosporum undulatum*, *Geijera Muelleri*, *Harpullia pendula*, *Sideroxylon australis*, *Eucalyptus redunca*, *Weinmannia lachnocarpa*, are good examples. *See also Plates* 2, 3, 6, 18, 29, 81.

(*d*) Interlocked.

In interlocked wood the salient feature is that the fibres especially, instead of being all in the same plane or straight longitudinally, as obtains in the case of straight-grained timber, intertwine with each other in masses running in an opposite curved direction to one another, such as *E. diversicolor*, *E. intertexta*, *E. squamosa*, which are good instances. This character must not be confounded with a wavy or undulating grain.

Fig. III.



INTERLOCKED TIMBER.
Karri, *Eucalyptus diversicolor*.

Such timber always shows great strength in compression and transverse tests.

This feature is sometimes spoken of by tradesmen as "short in the grain," but it is an incorrect term, for the fibres may not be short although interlocked.

(*e*) Short Grained.

Short in the grain is only another way of stating that the fibres and tracheids are quite limited in length and have thin walls, a feature more prominent in pines than hardwoods, and amongst the latter may be mentioned—*Acacia penninervis, Angophora melanoxylon, Eucalyptus dealbata, E. affinis.* *See also Plates* 61, 62.

(*f*) Wavy.

A wavy-grained timber has the fibres not interlocked but running in waves or undulations, either in the form of "Fiddle Back" *(infra)* or larger waves, and it is this character, so common in our hardwoods, that is now beginning to be so much appreciated. Some of the finest decorative and cabinet work can be made from wood having this feature; several of the Ashes and Stringybarks so treated and polished look exactly like Satinwood, amongst these may be mentioned,—*Eucalyptus delegatensis, E. rostrata, E. obliqua, E. maculata, Ratonia tenax, Acacia Cambagei, A. melanoxylon,* and many others. This figure can be seen in the commonest of fences, fruit boxes, posts, &c. It is shown also in several of the coloured plates.

(*g*) Silver Grain, or Quartered.

Silver Grain is only a term to mean that the wood has been cut radially or on the quarter, and has no meaning in the sense in which the word "grain" is used in the above cases. It is not generally employed in Australia, the term to express the same thing is "Cut on the quarter." The best of our timbers showing "Silver Grain" are,—*Casuarinæ, Grevilleas, Hakeas, Banksias, Villaresia Moorei, Tarrietia argyrodendron.*

FIGURE.

This feature might be divided into two classes (*a*) Wavy, (*b*) Radial or Silver Grain, both described above.

Australian timbers often possess some very fine examples of figuring, and one in particular is characteristic of many Natural Orders, *i.e.*, that known as "Fiddle Back." In this case the figures are of short undulations as opposed to the large undulations in big figures, such as are seen in the softwoods *Cedrela Toona, Flindersia Chatawaiana,* and hardwoods *Acacia melanoxylon, Banksias, Grevilleas.*

Fiddle back may be found in almost any species of Eucalypts, and many other hardwood genera, and is by no means an uncommon feature amongst Australian trees. It is illustrated in this work by *E. Delegatensis* (turned bowl) and *E. obliqua,* Plate 62. Its occurrence has been the subject of much controversy.

The author is of opinion that it is caused by the tree growing at first very rapidly and so the fibres have unduly lengthened, especially the tapering ends, then,

FIG. IV.

SATINWOOD GRAIN.

FIG. V.

T. C. Roughley, Photo.]

FIDDLE BACK GRAIN.

These beautiful, natural grains (Figs. IV and V) can be seen on common and rough hardwood (Eucalyptus) fences in almost any part of Australia.

when the big head of the tree develops, the super weight bends the fibres, and especially these ends, thus causing them to buckle—the wind storms greatly assisting—and so a crumpled or wavy appearance is the result. It is nearly always found in the buttresses, even if the tree otherwise is straight grained.

That these fibres are not interlocked can be proved by the easy manner in which they split with an axe. But this is not the only feature for which Australian timbers are famous, their pronounced radial (silver grain) figures, especially seen in the Proteaceæ and Casuarineæ, being very marked characters.

In the case of the Eucalypts the rays are so very small that it is rarely they can be seen except under a pocket lens, and so do not contribute in any way to the figure in the Genus. The large figures so frequently seen among the species are produced by the disposition of the fibres in large waves.

FIG VI.

T. C. Roughley, Photo.] [*Half Natural Size.*

FIDDLE BACK GRAIN

Eucalyptus Delegatensis.

TEXTURE.

This word should only be used to describe the comparative size, fineness, or coarseness of the elements which go to make up the whole wood structure, and not their disposition as explained under grain *(supra)*.

This character can be well demonstrated in the extremes of Eucalyptus timbers, such as *E. oreades*, "Mountain Ash," and *E. siderophloia*, "Red Ironbark." In the former the fibres, parenchyma, and vessels are much less solid in character than those of the latter, when the fibres are very thick walled and very closely packed.

III. TASTE.

Probably every timber has a characteristic taste although not easy to describe, but it is occasionally useful in assisting in the identification of timbers.

This feature is due to the presence of certain soluble substances employed by the tree in the building up of the tissues, or the result of a waste product deposited in the vessels, parenchyma cells, or lumen of the fibres, and is more marked in the secondary wood than the sapwood.

Eucalyptus microcorys, "Tallow-wood," has a very distinct astringent taste due to the tannin in it, amounting in this case to over 7 per cent.

IV. SCENT OR ODOUR.

As far as Australian timbers are concerned this feature is not wanting, but of course as obtains in other forest timbers it is more pronounced in some woods than in others.

It may be stated at once that each timber has probably its own characteristic perfume, although in a large number of cases, it is not easy to describe, or place in the range of perfumes.

The pronounced odour of some timbers readily differentiates them from their congeners. Thus *Ceratopetalum apetalum*, "Coachwood," has a distinctive aroma (Courmarin,—this alone being quite sufficient for identification), and when this odour is known it is impossible to confound any other wood with the species. The name Sandalwood is applied to several distinct Australian species of woods, yet the odour is characteristic in every case.

A few have received their vernacular names from an inherent property, which correctly describes the aroma of each, as in the case of *Owenia cepiodora*, "Onionwood"; *Dysoxylon Fraserianum*, "Rosewood"; *Senecio Bedfordii*, "Dog-wood"; *Olearia argophylla*, "Musk"; *Tarrietia argyrodendron*, "Crowsfoot Elm"; *Acacia acuminata*, "Raspberry Jam"; *Eucalyptus Gunnii*, "Cider Gum"; and *Croton phebalioides*, "Musk."

The fumes of several hardwoods are characteristic, as for instance in the out west country where *Acacia Cambagei*, "Gidgea," wood is being used for fuel, the atmosphere at evening, when household fires are being lighted, is redolent with a very pleasing odour.

Aroma is due in these cases to various constituents, such as essential or expressed oils, camphors, and other determined and undetermined substances, and much research yet remains to be done in this direction upon our Australian trees.

This odour enters largely into the employment of timbers in commerce, and either adds to, or detracts from, its use in certain trades. Thus the cigar-maker selects a timber for boxes that is reputed to give a pleasing aroma to the cigars, whilst the dairyman requires a timber that shall have no aroma, for it is a *sine qua non* with him that his butter boxes shall be non-aromatic, or otherwise his dairy commodity will be tainted and so considerably depreciated in market value.

The other principal odoriferous timbers are:—*Acacia homalophylla*, "Yarran"; *A. pendula*, "Myall"; *A. harpophylla*, "Brigalow"; *A. Cambagei*, "Gidgea"; *Santalum cygnorum*, "Sandalwood"; *Eremophila Mitchelli*, "Budda" or "Sandalwood"; *Evodia xanthoxyloides*.

The Callitris species of the interior; *C. Macleayana*, "Stringybark Pine"; *Dacrydium Franklini*, "Huon Pine," are all Coniferæ timbers possessing their individual perfume.

V. WOOD STRUCTURE.

GENERAL.

This section of Australian xylology is almost a new field of research, so the microscopical structures of typical timber specimens of the principal Natural Orders and Genera which were investigated are here described and illustrated.

For the student working in this branch of our hardwoods, it may be mentioned that wood, as such, is derived from primary cambium and secondary wood. By primary is meant that earliest portion of the stem at its growing apex, which later becomes differentiated into three distinct parts, viz.: (1) protoderm at the outside; (2) the procambium strands; (3) the fundamental or ground tissue.

It is from these three that the timber and bark structure as we know them are evolved. One becomes the epidermis; two the vascular bundles, which are arranged in a circle; three the centre or pith material, being separated by primary rays, pericycle and primary cortex.

We, however, are more particularly concerned in the vascular bundles, for it is these that contain the bases of the main parts of a timber tree; thus the outer portion is called the phlœm, from which is derived the bark of trees; the inner portion, the xylem, the original of the secondary wood of a tree; and the middle of the bundle is known as the cambium,—the generative tissue of both bark and timber, for it is from this structure that the tree receives its sustenance and is built up, the timber from the outer side and the bark from the inner side.

As it is from these that later structure is developed they are termed primary, in contra-distinction to the tissue generated by them which is designated secondary wood.

Now the origin of secondary timber is traceable to the cambium, which, as stated above, is that layer of cells between the bark and sapwood. These cells are very delicate in their structure, being thin walled, and so are easily ruptured, as can be noted when bark is torn from a tree. They are vertically elongated cells filled with protoplasm and plant food, and their chief function is the building up of bark on the one hand and wood on the other; by their action new layers of inner bark are added and at the same time new layers of outer wood, and thus these two main parts or organs of the tree are built up. The cambium, as these cells are technically called, is so essential to the life of the tree that girdling—"ringbarking" in Australia—is quite effectual in killing the tree, for, in other words, such action cuts away the cambium and so the tree is doomed or ceases to live.

What is commercially known as timber is botanically styled SECONDARY WOOD, and as it is this part of the tree with which this work is especially

concerned, perhaps a little fuller description of this structure may be given than that concerning the primary wood, cambium, and bark.

It is built up of wood elements, the three principal being (1) vascular, (2) fibrous, (3) parenchymatous, whilst organic substances such as resins, oils, mineral salts, and other constituents are also included.

1. VASCULAR STRUCTURES.

(*a*) Vessels.

Before explaining this term it might, perhaps, be as well to state that the botanical kingdom is divided for systematic classification into Phanerogams and Cryptogams, the latter including the lower forms of life such as Ferns, Mosses, Fungi, etc., with which of course we are not dealing. It is, however, the section known as Phanerogams which covers the two timber divisions, *i.e.*, Dicotyledons and Gymnosperms, the latter including the whole of the Coniferæ, along with other groups of no timber importance. It is in Dicotyledonous trees that true vessels occur, the exceptions being very few, such as *Drimys aromatica* for an Australian instance.

Vessels are composed of cells in the same plane, the absorption of the end walls of cells forming a complete tube. They are of various kinds deriving their specific name from the character of the thickening or strengthening of their walls.

Thus those which have their walls thickened by rings or hoops are called annular vessels, those with a spiral band spiral vessels, those with a number of slit-like pits arranged one above the other like rungs of a ladder are named scalariform vessels, and reticulate vessels when the secondary thickening has a mesh-like character. In some instances we find in the walls of the vessels a class of pits known as bordered pits, and the vessels having these bordered pits are known as bordered pitted vessels. These pits are concave in form with the top of the concavity opening into the lumen of the vessels. It is found that the pits in the walls of the contiguous vessels are always opposite one another and only separated by a very thin wall as seen in several of the micro-illustrations given under the species.

The function of these vessels, or tracheæ, is to provide the tree with the means of a water supply for its sustenance, and when this office ceases, they become closed (tyloses) by the thin walls of the parenchyma cells protruding into the lumen, and are then filled with air and water, and in some cases, gum, resin, manganese compound, oils, tans, etc., etc.

They vary in number and size, also in diameter, in different species, sometimes even extending the whole length of the tree. In cross section they are known as pores, and the expression "a porous timber" describes the nature of a wood from this view.

(*b*) Tracheids.

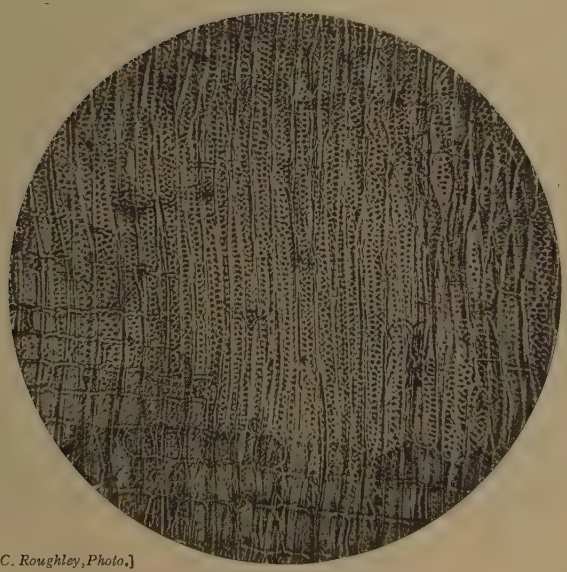
In the structure of Pine woods, which in a general timber sense are made to include all the Coniferæ, there is a marked difference from that of the Dicotyledons. The xylem or wood of the former is composed almost entirely of tracheids and ray parenchyma, the former being practically characterised by the bordered pits on the radial walls, and only in a few cases are spiral thickenings of the inner walls found.

They are spindle-shaped, and when thickened, as in the Autumn growth, much resemble fibres in cross section. But these are not entirely restricted to Coniferæ, as they occur plentifully in *Drimys aromatica* and some of the Eucalyptus woods, and probably many more Australian not yet investigated. In the latter case they are very much shorter and not so straight as in Conifers.

FIG. VII.

TRANVERSE SECTION
of timber of *Drimys aromatica.*

FIG. VIII.



T.C. Roughley, Photo.]

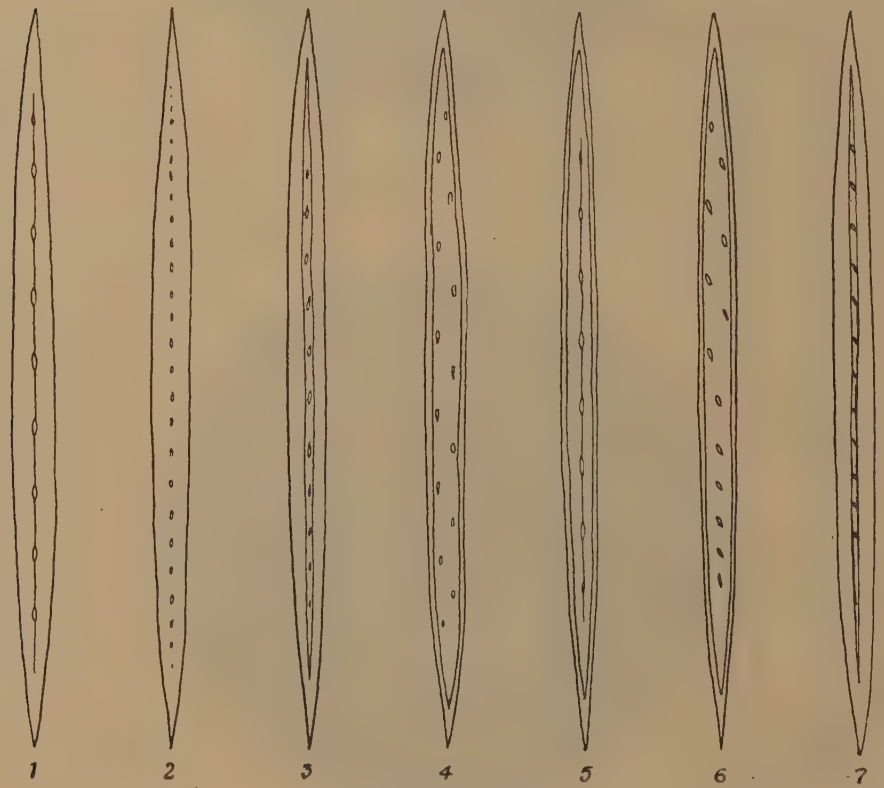
RADIAL SECTION
Drimys aromatica, showing tracheidal structure of timber.

2. FIBROUS BODIES.

These are divided into two kinds, wood fibres and septate wood fibres, and both these only occur in the dicotyledonous timbers and not in the Conifers. They vary in number in different Orders and Genera, and even in the species of a Genus such as Eucalyptus, as for instance in the case of Ironbarks, *E. crebra* and *E. paniculata*, and some of the Gums, *E. oreades* or *E. rubida*; in the former they are very closely packed with much thickened walls and the narrowest of lumen, and form the bulk of the structure, hence the great weight of these timbers; whilst in the latter or in all light timbers they have comparatively thin walls and a large lumen. Hence these woods, having a lower specific gravity, float in water. They are long needle-shaped cells, with mostly narrow pits, straight or oblique in the walls, the chief function being mainly that of mechanical support. Those which retain their protoplasmic contents are termed fibrous cells, the fibre proper having lost this substance and retaining only air and water. In several Eucalypts the fibres contain a red substance in their interior cavities or lumen.

The septate fibres are those which are found with delicate transverse partitions or cells dividing them into chambers. This kind of fibre appears to be rare in Australian species.

FIG. IX.



HARDWOOD FIBRES.

1. Weinmannia lachnocarpa. *2. Villaresia Moorei.* *3. Eucalyptus microcorys.* *4. Alphitonia excelsa.* *5. Eucalyptus oreades.* *6. E. Delegatensis.* *7. E. siderophloia.* All highly magnified.

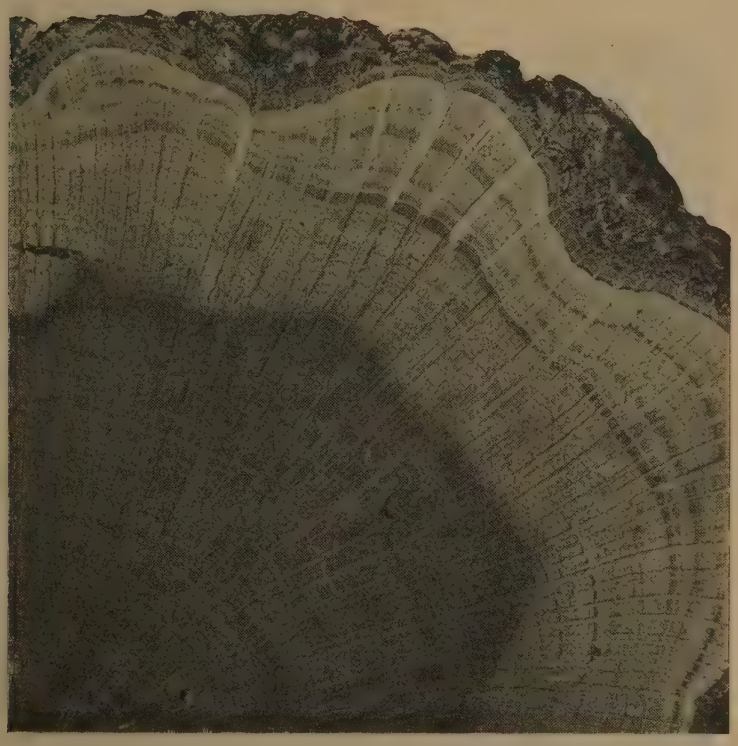
3. PARENCHYMATOUS ELEMENTS OR BODIES.

This structure occurs in the secondary wood or xylem of all Dicotyledons and Gymnosperms, being disposed in (1) a vertical, and (2) horizontal ray planes. It is composed of groups of short cells, the vertical end ones sometimes tapering to a point, being generally found grouped around the larger vessels or pores in the timber.

(1) VERTICAL OR WOOD PARENCHYMA is tissue composed of thin walled cells of cellulose, more or less scattered throughout the xylem. It consists mostly of elongated cells, oblong in form, with the exception of the end ones, which may or may not be pointed. They nearly always contain living contents, the walls being pitted with single pits. These cell walls may undergo a chemical change, the cellulose being converted into lignone as in the fibres.

The disposition of wood parenchyma cells is of some taxonomic value, for they are found arranged in various forms in different Genera or Species, as for instance in Eucalypts they occur clustered around the large vessels or pores, or scattered amongst the wood fibres. This is well seen in the various transverse micro-sections of *Eucalyptus* species. In Proteaceous timbers such as "Silky

FIG. X.



TRANSVERSE SECTION OF PORTION OF STEM.

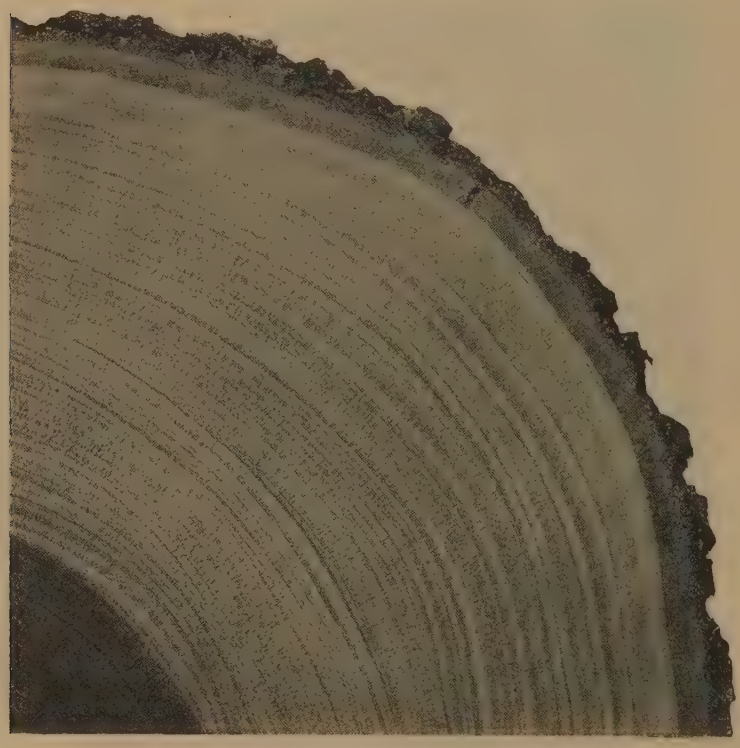
Showing the very conspicuous medullary rays (natural size), the most pronounced of all Australian hardwoods.

BULL OAK, *Casuarina Luehmanni.*

Oaks," *Grevillea robusta* and *Orites excelsa*, they occur in a cross section in curved bands between the curved bands of fibres and separated by the rays, in others they are liberally distributed throughout the wood structures, whilst being exceedingly rare in "Red Ash," *Alphitonia excelsa*.

(2) MEDULLARY OR HORIZONTAL PARENCHYMA is found in all woods with one exception "Grey Mangrove," *Avicennia officinalis* (see paper by Author, "Journ. Roy. Soc., N S.W., Vol. XLIX, 1916"). It is composed of rows of cells extending from the pith or centre of the tree right through the heartwood and well into the bark. These are known botanically as medullary rays, and when exposed on the quarter or radially are known by craftsmen in Australia as figure, and silver grain in other parts of the world. They are more pronounced in some timbers than others, and, amongst Australian timbers, are more conspicuous in Casuarinas than any other timber in the vegetable kingdom. A remarkable exception in this genus is "Belah," *Casuarina Cambagei*, which shows no medullary rays macroscopically, the largest being found in "Bull Oak," *Casuarina Luehmanni*, and some of the Grevilleas, Bull Silky Oak, etc., whilst in others, such as the Eucalypts they are very numerous, though scarcely to be seen with the naked eye, the "figure" so common amongst this group of trees being due to the wavy arrangement of the fibres and not to the rays as generally thought.

FIG. XI.



TRANSVERSE SECTION OF PORTION OF STEM.
The medullary rays are scarcely discernible—a remarkable contrast to its congeners.
BELAH, *Casuarina Cambagei.*

Microscopically examined radially, they appear something like looking on or at a brick wall, the width from this view indicating the number of cells forming the height of the ray, and which may be either one or several cells high, these latter being arranged either regularly, as in Eucalyptus, or promiscuously, as in Casuarina, Banksia, Grevillea, etc.

The radial walls have simple perforations, large or small, communicating with the cognate cells, adjacent vessels, and wood elements.

In a tangential section the ends of the rays are clearly distinguishable microscopically in most genera, and it is in this view that the correct height, shape, width, and distribution can be ascertained, as well as the shape in cross section of the component cells; and also by this means can the uniformity or otherwise of the rays be best detected, *i.e.*, whether they are uniseriate (one cell in width), or many celled, when they are known as multiseriate, both forms being often found in the same timber.

The number of cells forming the height of the ray is best ascertained from this section, as one is not always certain in a radial section whether the whole height of the ray is in the plane of the cut.

The cells vary in the disposition of their long axis, which is either vertical or horizontal, the exception being the former, and according to this particular feature the rays of the latter are known as homogeneous, or heterogeneous when possessing both shapes. The latter is a frequent form found in Australian timbers.

VI. SAPWOOD.

This portion of the tree is generally lighter in colour than that of the heartwood, from which it differs very much more materially than in that character, for here are the growing or developing cells of the tree wood, cells having a protoplasmic content, and, when losing this, merge into the heartwood, the main function of which is to aid in the mechanical support of the tree.

It is not always easy to detect where the sapwood ends and the heartwood begins even by colour, but in practice it can sometimes be tested by the limitations of wood boring beetles, which so readily attack the sap, but rarely, if ever the heartwood. Again, sapwoods in very many instances of our hardwoods are immune from these destructive animals, but in the case of Eucalypts two exceptions may be cited, *E. obliqua* and *E. maculata*, which are noted timbers for the rapidity with which the borer attacks and destroys the sapwood—remarkable exceptions in a class of timbers almost entirely immune from such pests.

The proportion of sapwood to heartwood varies in the different species, and in inspecting timbers for economic purposes, care is required not to confound one with the other, especially in the absence of colour, but even the latter feature is not always a sure indication of the limits of heartwood and sapwood. No better instance of this can be given than in the case of *Alphitonia excelsa* (Red Ash), for in a log 24 inches in diameter, the centre portion (12 inches) is a bright red and the remainder pale or white, which to a novice would at once be determined as sapwood, when such is not the case. A few other instances occur in *Rutaceæ*, *Sapotaceæ*, *Simarubeæ*.

The Ironbarks are especially free from sapwood, considered in a commercial sense, and so, with the exception of the two species above mentioned, Eucalypts (in a commercial sense) may be said to be particularly free.

As a rule "sapwood" is rather a rare character of Australian hardwoods, being quite a limited portion of these trees. In some Natural Orders it is difficult to detect at all, such as *Rutaceæ*, *Myrtaceæ*, *Sapindaceæ*, and *Euphorbiaceæ*.

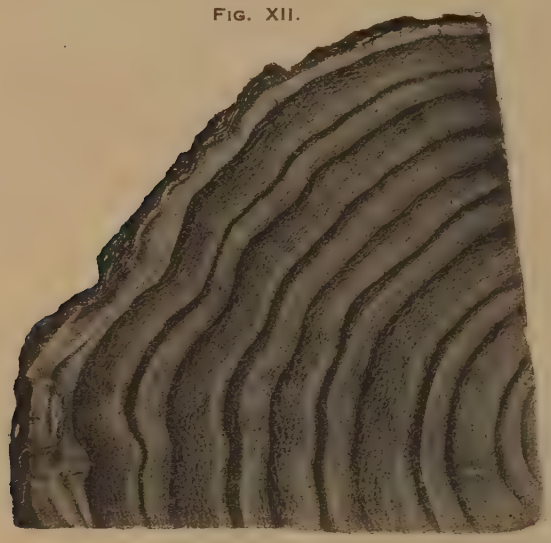
VII. ANNUAL RINGS.

A transverse section of most trees will show that it is characterised by a number of concentric rings which are known as growth or annual rings, corresponding in a general way to the age of the tree in years.

Each ring consists of two parts, an inner light colour and an outer dark colour, the former being that portion formed during the spring of the year, and the latter the late summer or early autumn.

Microscopically examined and speaking generally the former is seen to be constructed of large thin walled elements of wood structure, and the summer or early autumn of smaller thick walled fibres, fewer vessels and parenchyma cells, so that each annual ring consists of a spring and autumn growth of wood.

FIG. XII.



TRANSVERSE SECTION [*Natural size*

of wood of *Leptospermum lanigerum*, showing the exceptional width of annual rings for a hardwood.

This autumn or winter growth of denser structure of the previous year is therefore bounded by the spring wood respectively of the preceding and succeeding year, and it is this close compact concentric ring that is so conspicuous an object in a transverse section of the timber, which is popularly referred to as the annual ring.

When counting the number of annual rings to estimate the age of a tree it is generally only this portion of the annual ring that is taken into account.

FIG. XIII.

Natural size]

TRANSVERSE SECTION.

Wood of *Eucalyptus regnans*, showing the wide annual rings of a quick-growing Eucalyptus.

In quick growing trees the rings are wider and so more pronounced than in the slow growing ones. In Conifers as a rule they are very conspicuous, varying in width in proportion to rapidity of growth, the thick walled tracheids denoting the autumn and winter growth.

The widest that has ever come under my notice (although not an Australian tree, yet worthy of mention here) is that of a Redwood, *Sequoia sempervirens*, at Reefton, New Zealand, the age, 27 years (given from authenticated data), being confirmed by that number of rings. It has a diameter of nearly three feet, with the ring width of an inch, probably one of the most remarkable rates of growth in the timber world.

Amongst Australian hardwood trees the annual rings, as a rule, are very fine and close, such as *Geigera*, *Achras*, *Melaleuca Maideni*, *Bosistoa sapindiformis*, *Alphitonia excelsa*, *E. populifolia*, *E. microtheca*, *E. rostrata*, and *E. punctata*. In a few Eucalypts they are quite pronounced, as for instance, *E. Delegatensis*, *E. oreades*, *E. regnans*, *E. aggregata*, *E. viminalis*, *E. rubida*. The width of a ring is not always uniform owing to the uneven development of a tree in its circumference, thus in this part of the world the more rapid growth is found to be on the north side, the opposite of course holding for the northern hemisphere, and this is determined by the external predominant factors such as light, heat, moisture.

In some instances, especially in the case of the harder Eucalypts, the rings are not at all well defined and quite difficult of detection, either macroscopically or microscopically, and often easier to trace in the former than the latter, the year's growth showing a uniformity of structure. These features are brought out in the illustrations of transverse sections of timber given under the various species.

Annual rings are of little value for specific determination, but are more of a help generically and even in Natural Orders.

VIII. WEIGHT.

This is one of the most important factors in the commercial value of a timber, as it necessarily governs the use of specific timbers for special purposes.

It is customary in most books on timber to give weights in specific gravity, a term rarely used in the trades so it is not given here, that being left to the student to work out for himself, which can easily be done by dividing the weight in pounds of a cubic foot by 62·425 (a cubic foot of distilled water at 4° C. weighs these pounds) which will give the result in specific gravity.

The weights given with each species are those of air dried, well seasoned timber, having only, of course, its atmospheric absorbed moisture which is generally 10 to 18 per cent.

The determining factor in deciding the weight of a timber should literally be the percentage of fibres, and the thickness of their walls, as well as those of the other wood elements. Weight would of course be considerably lighter in the case of thin walled cells, when the wood would be classed as light, and if very thick, as in the case of Eucalypts—Ironbarks—then the timber is heavy, as well as dense, which latter feature characterises very many of the species mentioned in this work.

It is practically impossible to extract all the moisture, air, and ingredients from the wood elements.

Some of the micro-illustrations show both the early and late growth in the annual rings, and this latter will give a very good idea of the two determining factors in the weights of woods.

Conifers are light in weight because of a difference in structure, as fibres and vessels are absent, their places being substituted by thin walled tracheids.

Green timber is heavy owing to the presence of water in the tissues, which often will add 50 per cent. or more to the weight of a wood, hence seasoned timber is always lighter than unseasoned timber. Individual weights are given under each species.

IX. TESTS.

Transverse tests were obtained by using a machine on specimens of timber of standard size 38 x 3 x 3, the bearings being distant 3 feet apart, the results for which I am indebted to Mr. J. Nangle, F.R.A.S., Superintendent of Technical Education, and Mr. H. J. Swain, B.Sc., Lect. of Mech. Eng., Technical College.

For more elaborate and intricate mathematical data concerning transverse tests larger size, compression, and tensile strength of Australian hardwoods, the student is referred to the researches of Professor W. H. Warren, Wh. Sch., Sydney University; G. A. Julius, B. Sc., M.E; J. Mann, University of Melbourne; Professor Chapman, B.A., B.C.E., University of Adelaide.

Laboratory tests, however, do not always coincide with practical ones and some of the results obtained in this direction are not regarded as satisfactory, the figures varying so much in pieces taken from the same log and tested in exactly the same direction of the wood elements. Commercially, Ironbark is acknowledged on all hands as the strongest of all our timbers, and yet other timbers with a much less reputation for strength broke under a greater weight. The same thing can be noticed in all lists published. A piece of *Dacrydium cupressinum*, Sol. "Rimu," a New Zealand pine, of not much repute for strength, broke at a greater weight than several specimens of Ironbark tested in a similar way and on the same machine.

Laboratory tests must in the opinion of the author be studied in conjunction with the empirical knowledge of the practical man.

X. DURABILITY.

It can be safely stated that the most distinguishing physical property of Australian hardwoods is their durability under the most varying adverse natural and artificial conditions. Specimens illustrating this special character are very numerous in this Institution, and the data too long to publish in this work, but a few are given:—

A slab of *Eucalyptus paniculata*, "Grey Ironbark," 11 ft. by 1 ft. 6 in. by 4 in. taken from a stable erected by Colonel Macarthur, 1793, on Elizabeth Farm, Parramatta, is in as good a state of preservation as when first cut after being exposed to all weathers for over a period of 100 years.

Railway Sleepers (Ironbark) from the permanent way in the main Western line, after 25 years show little effects of the heavy traffic.

A log of *Eucalyptus resinifera*, "Forest Mahogany," taken from the wreck of the Boyd (cargo) after being submerged for 86 years in New Zealand waters, has shown no sign of decay.

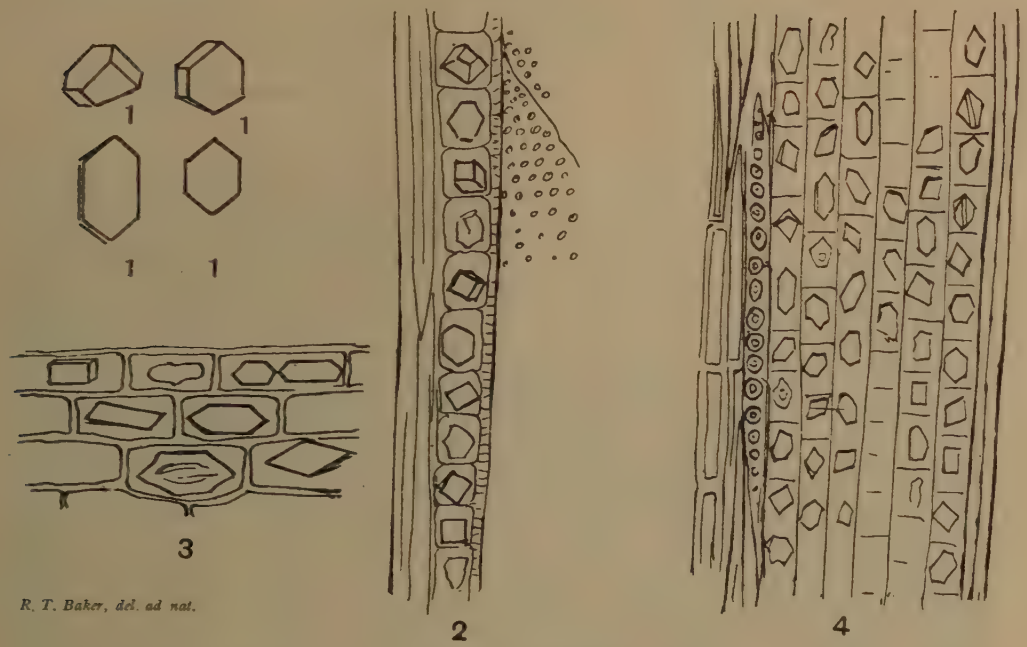
A specimen of *Angophora subvelutina*, flooring board from Mr. W. L. White, of Scone, has worn splendidly, although resting quite close to the ground and with no ventilation, after 80 years.

The majority of the hardwoods are very durable in the ground and a number in water, in the latter case especially *Syncarpia laurifolia*, "Turpentine," and *Eucalyptus* spp., "Ironbark."

Very many other instances are available proving the superiority of Australian hardwoods where durability is a desideratum.

XI. CRYSTALS.

FIG. XIV.



(1) Crystals in transverse section of timber of *Weinmannia lachnocarpa*. (2) Crystals in tangential section of same species. (3) Crystals in a ray of *Villaresia Moorei*. (4) Crystals in a tangential section of *Acacia pendula*, Myall. All highly magnified.

In the microscopical examination of these hardwoods, crystals were found in timbers of the following natural orders:—*Pittosporeæ*, *Sterculiaceæ*, *Olacineæ*, *Verbenaceæ*, *Rhamneæ*, *Sapindaceæ*, *Myrtaceæ*, *Anacardiaceæ*, *Leguminoseæ*, *Saxifrageæ*, *Ebenaceæ*, *Apocyneæ*, *Euphorbiaceæ*, *Casuarineæ*. They were undissolved after a long immersion of the timber in hydrofluoric acid, nor did they polarise when examined *in situ*, but only after separation from the wood. They may be classed as solitary crystals of calcium oxalate, usually of the rhombohedra form, and of a rather uniform size.

XII. COMPARATIVE COMBUSTIBILITY OF TIMBERS.

This is a subject that has received not much attention from timber experts in other parts of the world for obvious reasons, but it may be mentioned that in this country where timbers enter so largely into the various branches of constructive works, it is of great importance. This, of course, is apparent to any one who gives the subject some thought, thus in wooden bridges in the brush, or on railway lines where there is a danger of bush fires, it is a great advantage to use timbers that will not readily burn. Again, in town warehouses where supporting storey posts and beams are preferred to iron, as the best fire resister should be employed if only to reduce the fire-risks and so keep down the fire insurance premiums. Then, again, timbers of this class should be used before iron, for if a fire occurs iron expands and buckles and so aids the fire in the destruction of the premises.

But recently a more important side to this has been developed especially in Australia, now that naval construction is being undertaken on a large scale.

One of the most important desiderata in a modern man-o'-war is a non-inflammable timber for inside use, and fortunately, Australia is able to supply the want from her indigenous timbers.

Mr. Rodney Cherry carried out, in 1903, an investigation on this subject with timbers supplied by this Institution, and the results are those given below.

From these it will be seen that the majority of our native timbers offer a better resistance to fire than the foreign timbers tested, and in this latter connection it may be noted that Rangoon Teak and English Oak show a rather low comparative resistance to fire. From amongst our native timbers, however, there are two that stand high as fire resisters, viz.—"Box," *E. Fletcheri*, R.T.B., and "Turpentine," *Syncarpia laurifolia*, such qualities alone justify the afforestation of these, although they both possess many other valuable features.

For these results, a "zylopyre" was used which consisted of four steel rods 15in. long, rising from each corner of a steel base 9in. square. These rods converge together at the top, where they embrace the upper end of a brass tube 6in. long, the lower end of the said tube being braced to the rods.

At a distance of 5¼in. from the base the rods are connected by a platform made of stout wire, and upon this platform, which is 4in. across, rests the little log of wood (6in. x ½in. x ½in.) which is to be tested. Across the centre of this log is placed the chisel-shaped end of a steel spindle, which travels vertically in the brass guiding tube, the top of the spindle being weighted. A spiral brass spring is fixed to the top of the machine so as to relieve it from the jar of the weighted spindle when the test is completed. A gas burner is so arranged that a "rat-tail" flame 1¾in. long impinges on the lower surface of the wood. This is so regulated that the conditions of test shall be identical in every case. The weighted spindle weighs 448·84 grammes (15·71 ozs. avoir.). The test begins when the log is placed in position over the gas jet, and ends when the spindle falls. The time is taken by a stop-watch measuring fifths of seconds.

Explanation of Tabulated List.

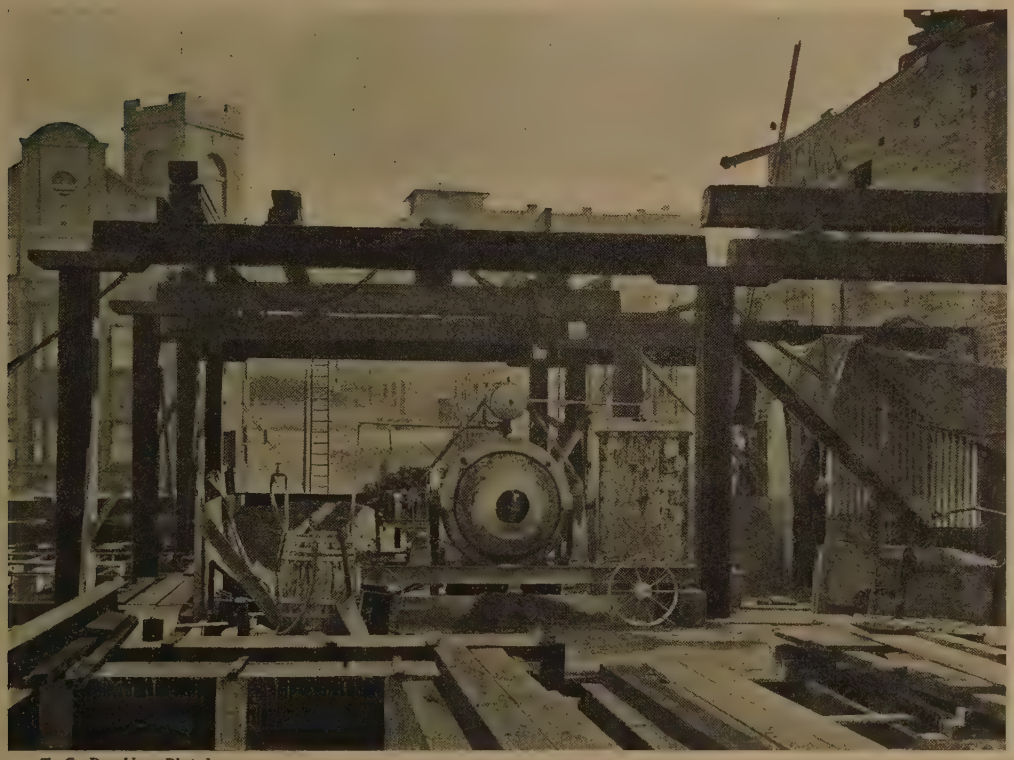
The timbers are arranged in the order of their fire resistance. The number in the first column is that of the specimen. Then follow the scientific and local names of the timbers,—the column headed "Test" giving the time, in minutes and seconds, of the endurance; that headed "Flame" giving the time during which the flame (if any) endured after the conclusion of the test; and that headed "Glow" showing the duration of the glow (if any) after the flame had expired. The weight of each test log is given in grammes and ounces avoirdupois, so as to facilitate reference by users of the Metric or British Systems.

Test Pieces.

The test pieces measure 6in. long by ½in square (15·24 centimetres long by 12·70 millimetres square). It will therefore take 96 of these little logs to make a plank 1ft. square by 1in. thick, 12 of these planks taken together equal a cubic foot.

If, therefore, we take the weight shown in the table for a test log in ounces avoirdupois, multiply this by 96, and divide the result by 16, we should get the weight in pounds of a square foot of the timber 1in. thick, and by multiplying this again by 12, we get the weight in pounds of a cubic foot.

Fig XV.



T. C. Roughley, Photo.]

IRONBARK GIRDERS AND POSTS.

These are often used now in place of iron supports and girders in large buildings owing to their greater resistance to the effects of fire.

COMPARATIVE COMBUSTIBILITY OF TIMBERS.

No. of Spec.	Name.	Author.	Local Name.	Test.		Flame.		Glow.		Weight of Spec.	
				M	S	M	S	M	S	Grammes.	Oz. Avoir.
42	Eucalyptus Fletcheri ...	R.T.B.	Box	19	17	...	...	...	...	30.21	1.05
39	Syncarpia laurifolia ...	Ten.	Turpentine	12	58	...	40	...	...	28.85	1.00
46	Casuarina torulosa ...	Ait.	Forest Oak	8	55	...	...	...	5	32.01	1.12
2	C. Luehmanni ...	R.T.B.	Bull Oak	7	53	...	...	...	...	31.33	1.09
40	Eucalyptus ovalifolia var. lanceolata.	R.T.B. H.G.S.	Red Box	7	44	1	5	..	...	30.20	1.05
5	Casuarina Cambagei ...	R.T.B.	Belah...	7	34	...	...	34	..	33.02	1.15
43	Eucalyptus acmenioides ...	Schau.	White Mahogany ...	7	28	1	15	..	...	25.93	.90
35	E. dealbata ...	A. Cunn.	Cabbage Gum ...	7	19	...	59	..	..	26.19	.91
18	E. eugenioides ...	Sieb.	White Stringybark ...	7	11	1	16	...	...	25.24	.88
38	E. Bridgesiana ...	R.T.B.	Woolly-butt	7	11	2	9	...	...	29.56	1.03
3	E. punctata ...	D.C.	Grey Gum	7	6	...	...	.	...	28.48	.99
60	E. tereticornis var. linearis.	R.T.B. H.G.S.	River Gum	7	6	...	...	...	25	23.58	.82
44	E. Planchoniana	F.v.M.	Stringybark	7	4	1	16	.	...	26.45	.92
25	E. ovalifolia ...	R.T.B.	Red Box	6	56	...	...	.	...	29.97	1.04
55	E. maculosa ...	R.T.B.	Spotted Gum ...	6	48	1	11	...	...	17.63	.61
92	E. microtheca ...	F.v.M.	Swamp Box	6	45	1	25	...	...	26.14	.91
1	E. melanophloia	F.v.M.	Silver-leaf Ironbark...	6	42	1	...	...	...	29.85	1.04
61	E. Maideni ...	F.v.M.	Blue Gum	6	35	1	36	...	...	25.51	.89
67	E. longifolia ...	Link and Otto.	Peppermint or Woolly-butt.	6	35	...	45	...	...	27.39	.95
81	E. macrorhyncha	F.v.M.	Red Stringybark ...	6	34	...	54	...	...	22.97	.80
52	E. Wilkinsoniana	R.T.B.	Small-leaf Stringybark	6	24	1	21	...	...	21.82	.76
8	E. quadrangulata	H.D. J.H.M.	Grey Box	6	16	2	25	...	...	27.69	.96
34	E. Woollsiana ...	R.T.B.	Mallee Box	6	11	1	44	...	...	31.51	1.10
29	E. tereticornis ..	Sm.	Red Gum	6	10	...	20	...	...	29.65	1.03
31	E. oleosa ..	F.v.M.	Red or Water Mallee	6	9	...	50	...	...	31.47	1.10
45	E. cinerea ...	F.v.M.	Argyle Apple ...	6	9	1	26	...	...	30.28	1.05
66	E. squamosa ...	H.D. J.H.M.	Ironwood	6	7	...	35	...	...	26.85	.93
53	E intertexta ...	R.T.B.	Spotted Gum ...	6	5	...	55	...	...	28.67	1.00
19	E. resinifera ..	Sm.	Mahogany	5	55	...	48	...	...	27.22	.95
82	E. capitellata ..	Sm.	Brown Stringybark	5	55	2	34	...	...	20.38	.71
9	E. microcorys ..	F.v.M.	Tallow-wood ..	5	53	1	30	...	...	27.59	.96
11	E. paniculata ...	Sm.	White Ironbark ..	5	49	...	47	20	...	33.53	1.17
14	E. Dawsoni ...	R.T.B.	Slaty Gum	5	47	...	55	...	...	31.12	1.08
59	E. bicolor ...	A. Cunn.	Bastard Box ..	5	47	1	11	...	35	26.57	.92
24	E. Smithii ...	R.T.B.	Gully Ash	5	42	...	55	...	...	28.68	1.00
102	E. marginata ...	Sm.	Jarrah (W.A.) ..	5	42	...	44	...	...	18.27	.63
117	E. siderophloia ...	Benth.	Broad-leaf Ironbark	5	39	1	14	2	...	29.40	1.02
51	E. laevopinea ...	R.T.B.	Silver-top Stringy-bark.	5	34	1	53	...	...	22.46	.78
7	E. saligna ...	Sm.	Sydney Blue Gum ..	5	31	...	45	...	...	27.15	.95
28	E. pendula ...	A. Cunn.	Red Box	5	30	...	30	...	...	29.96	1.04
15	E. dextropinea ...	R.T.B.	Stringybark	5	29	...	50	...	...	19.89	.69
12	E. sideroxylon ...	A.Cunn.	Red Ironbark ...	5	25	...	...	...	...	25.72	.90
54	E. nigra	R.T.B.	Black Stringybark ..	5	21	1	30	...	...	22.73	.79
64	E. Bosistoana ...	Miq.	Box	5	19	1	10	...	...	24.94	.87
68	E. dives	Schau.	Peppermint	5	19	1	8	...	...	16.70	.58
50	E. Morrissii ...	R.T.B.	Grey Mallee	5	17	1	52	...	...	26.52	.92
93	E. albens ...	Miq.	White Box	5	17	2	12	...	...	28.31	.99
94	E. hemiphloia ...	F.v.M.	Box	5	16	1	31	...	...	27.95	.97
17	E. rostrata ...	Schl.	Red Gum	5	15	...	49	...	...	27.18	.95
65	E. tessellaris ...	F.v.M.	Carbeen	5	12	...	48	19	...	20.62	.72
47	E. intermedia ...	R.T.B.	Bastard Bloodwood..	5	9	1	16	...	...	25.66	.89
62	E. melliodora ...	A. Cunn.	Yellow Box	5	7	1	55	...	...	28.13	.98
30	E. viridis ...	R.T.B.	Green Mallee... ...	5	4	1	25	...	...	32.17	1.12
10	Tristania conferta... ...	R.Br.	Brush Box	5	2	...	53	25	...	26.19	.91
36	Eucalyptus Rossii ...	R.T.B. H.G.S.	White Gum	4	50	1	3	...	...	24.35	.85
105	E. crebra ...	F.v.M.	Small-leaf Ironbark...	4	48	...	45	...	...	28.19	.98

COMPARATIVE COMBUSTIBILITY OF TIMBERS—*continued.*

No. of Spec.	Name	Author.	Local Name.	Test.		Flame.		Glow.		Weight of Spec.	
				M	S	M	S	M	S	Grammes.	Oz. Avoir.
4	Eucalyptus corymbosa ...	Sm.	Bloodwood	4	47	...	45	...	...	22.58	.79
20	E. pilularis ...	Sm.	Blackbutt	4	47	...	...	...	...	23.96	.83
26	E. paludosa ...	R.T.B.	Yellow or Swamp Gum.	4	38	...	46	...	...	24.61	.86
58	E. angophoroides	R.T.B.	Apple Top Box ...	4	38	1	24	12	...	23.62	.82
63	E. gracilis ...	F.v.M.	Mallee	4	38	1	15	8	...	29.32	1.02
95	E. goniocalyx ...	F.v.M.	Mountain Gum ...	4	30	...	50	...	...	19.00	.66
41	E. maculata ...	Hook	Spotted Gum ...	4	23	1	12	3	...	25.95	.90
109	E. globulus ...	Labill	Tasmanian Blue Gum	4	18	2	40	...	...	22.22	.77
56	E. populifolia ..	Hook	Bimbal Box	4	15	1	15	...	...	29.94	1.04
13	Stenocarpus salignus ...	R. Br.	Beefwood	4	8	1	10	...	...	25.52	.89
70	Eucalyptus viminalis ...	Labill	Manna Gum ...	4	5	...	50	...	...	19.67	.68
88	E. robusta ...	Sm.	Swamp Mahogany ...	4	5	...	55	...	...	22.14	.77
27	E. dumosa ...	A. Cunn.	Bull Mallee	4	4	1	12	20	...	27.99	.97
89	E. botryoides ...	Sm.	Bangalay	4	4	1	18	...	20	21.70	.75
91	Quercus sp.	.....	Dantzic Oak (Europe)	4	1	1	29	11	...	21.36	.74
107	Eucalyptus piperita ...	Sm.	Sydney Peppermint	4	1	1	41	...	...	19.67	.68
71	E. hemilampra ...	F.v.M.	Bastard Mahogany ...	3	59	...	48	...	...	20.07	.70
23	Pseudotsuga Douglassii ...	Britton	Oregon (U.S.A.) ...	3	57	...	45	...	...	17.78	.62
99	Acacia salicina	Lindl.	Eumung	3	54	...	40	1	...	22.06	.77
48	Eucalyptus Delegatensis...	R.T.B.	Mountain Ash ...	3	46	2	30	...	...	18.15	.63
98	E. fraxinoides ...	H.D. J.H.M.	White Ash	3	46	...	59	...	...	17.61	.61
97	Angophora intermedia ...	D.C.	Apple Tree	3	45	...	48	17	...	20.41	.71
57	A. melanoxylon ..	R.T.B.	Coolabah or Apple ...	3	43	...	58	20	...	25.57	.89
103	Eucalyptus diversicolor ...	F.v.M.	Karri (W.A.) ...	3	41	...	51	...	...	20.62	.72
49	Callitris calcarata... ...	R. Rr.	Black Pine	3	37	1	40	18	...	21.16	.74
84	Eucalyptus radiata ...	Sieb.	Silver Top	3	36	1	10	1	...	20.95	.73
33	E. Cambagei ...	H.D. J.H.M.	Bastard Box or Bundy.	3	34	...	58	13	...	21.55	.75
116	Melaleuca leucadendron ...	Linn.	Tea Tree	3	34	1	10	17	...	21.82	.76
83	Flindersia australis ...	R. Br.	Mountain Ash ...	3	32	1	2	8	...	18.12	.63
100	Scolopia Brownii ...	F.v.M.	Brush Cherry ...	3	30	...	39	17	...	24.95	.87
104	Eucalyptus calophylla ...	R. Br.	Red Gum (W. A.) ...	3	27	1	12	14	...	20.04	.70
87	Geijera salicifolia ..	Schott	Axe Breaker... ...	3	26	1	1	15	...	25.52	.89
6	Grevillea robusta ...	A. Cunn.	Silky Oak	3	24	...	50	12	30	18.53	.64
113	Tectona grandis	Linn.	Teak (Burma) ...	3	23	...	42	14	...	16.37	.57
110	Pinus sylvestris	Linn.	Red Deal (Baltic) ...	3	21	1	8	...	...	15.10	.52
69	Eucalyptus fastigata ...	H.D. J.H.M.	Cut Tail	3	19	...	51	...	...	19.80	.69
16	E. oreades ...	R.T.B.	Mountain Ash ...	3	16	1	25	...	...	17.38	.60
22	Pinus australis	Mich.	Pitch Pine	3	12	...	31	...	26	16.19	.56
76	Dysoxylon Muelleri ..	Benth.	Red Bean	3	12	...	55	...	...	15.25	.53
32	Eucalyptus amygdalina ..	Labill.	Messmate	3	10	1	35	...	...	19.42	.67
101	Callitris robusta	A. Cunn.	White Pine	3	7	...	30	15	...	18.46	.64
73	Dysoxylon Fraserianum ...	Benth.	Rosewood	3	5	...	29	4	...	15.29	.53
37	Agathis australis	Salisb.	Kauri (N.Z.)... ...	3	4	...	46	...	20	18.10	.63
112	Quercus alba	Linn.	White Oak (U.S.A.)	3	1	...	47	3	...	16.13	.56
75	Castanospermum australe	A. Cunn.	Black Bean	2	52	1	40	...	...	18.02	.63
111	Quercus robur	Linn.	Oak (England) ...	2	49	...	45	16	...	16.19	.56
106	Fagus Cunninghamii ..	Hook.	Beech or Red Myrtle (Tas.).	2	47	...	31	2	...	15.04	.52
86	Stenocarpus sinuatus ...	Endl.	Fire Tree	2	44	...	50	10	...	15.98	.55
114	Juglans sp.	.....	Walnut (U.S.A.) ..	2	42	1	21	11	...	17.17	.60
79	Cedrela australis	F.v.M.	Red Cedar	2	40	...	19	2	...	10.70	.37
90	Capparis nobilis	F.v.M.	Wild Lemon ...	2	39	...	19	17	...	19.04	.66
85	Orites excelsa	R. Br.	Silky Oak	2	35	...	45	5	...	16.70	.58
77	Gmelina Leichardtii ...	F.v.M.	Beech	2	31	...	35	10	...	16.79	.58
108	Elaeocarpus grandis ...	F.v.M.	Large Blue Fig. ...	2	30	...	51	1	...	11.98	.41
80	Ceratopetalum apetalum ..	D. Don.	Coachwood	2	29	...	35	12	...	16.06	.56
21	Fagus sylvatica	Linn.	Beech (England) ...	2	25	...	6	15	...	16.72	.58
96	Sequoia sempervirens ...	Lindl. and Gord.	Redwood (U.S.A.) ...	2	24	...	36	2	...	11.94	.41
74	Acacia melanoxylon ...	R. Br.	Blackwood	2	21	...	26	2	...	14.52	.50
72	Araucaria Cunninghamii...	Ait.	Colonial Pine ...	2	14	...	45	5	...	13.51	.47
78	Litsea reticulata	Meissn.	She Beech or Bolly Gum.	2	11	1	23	7	...	13.23	.46
115	Kahiakatea	.....	White Pine (N.Z.) ...	1	46	...	46	10	...	9.44	.33

PART II.

INDIVIDUAL SPECIES OF HARDWOOD.

(a) GENERAL.

For convenience of a Forestry and Commercial classification our Hardwoods might be divided into three classes :—

I. Forest timbers.
II. Brush timbers.
III. Littoral timbers.

I. FOREST TIMBERS.

These may readily be sub-classed as Eucalypts and non-Eucalypts.

EUCALYPTS.

These wonderful trees, which practically are indigenous to Australia, are in a class by themselves, and form the most predominating character of the Australian flora, and quite three-quarters of its vegetation.

All are known in a general way as "Gum Trees"—the name given by the first settlers in reference to the Red Kino exudation, which was mistaken for a "gum." Vernacularly they have since been divided into well-defined groups such as Bloodwoods, Mahoganies, Boxes, Tallow-woods, Woollybutts, Stringybarks, Gums, Blackbutts, Peppermints, Ashes, and Ironbarks, the common names having been bestowed upon them in reference to some natural feature such as bark, timber, mode of growth, constituent in the oil, physiological, or some other characters. As these names have now gained a systematic as well as a technological significance they are preferred in this work for classification purposes.

Botanically these belong to the Natural Order Myrtaceæ, the genus Eucalyptus having more tree species than any other Order in Australia.

They are evergreens, and generically distinguished (particularly) by the bud, which has a lid or operculum covering the organs of reproduction, hence the name. The leaves are also characteristic and differ in many features from most foliage. They are either lanceolate, falcate, or cordate in form, and possess a varied venation and an essential oil according to the above groups.

The fruits are mostly cup shaped, and the seed small for so large a tree.

The timber, invariably classed as a hardwood, is heavy, close-grained, frequently interlocked, and in colour either pale-grey, brown, pink, or red.

FOREST COUNTRY.
Showing natural reafforestation.

Photo [T. Dick

FOREST COUNTRY
Showing trees of *Eucalyptus maculata*. SPOTTED GUM.

The bark is either deciduous and smooth, or persistent,—when it is subdivided into (1) stringy, or (2) hard, compact, furrowed, with varying other specific features. (*See also* INTRODUCTION TO EUCALYPTS.)

The Bloodwoods are placed first because the results of the researches carried out at this Institution on the Genus point to these being the oldest group from an evolutionary point of view.

NON-EUCALYPTS.

The N. O. Myrtaceæ, to which the Eucalypts belong, produce some excellent hardwoods other than those of that great branch of the Forest Flora, as for instance those of the Angophora, Tristania, Syncarpia, Eugenia, Melaleuca, the latter, although neglected, is yet one of the finest of hardwood timbers.

The forest includes other species from various Natural Orders, the largest number being perhaps those of the Leguminosæ, and of these the Acacias predominate.

The N. O. Leguminosæ has both forest and brush timbers, the former producing some of our hardest woods, such as Myall, Gidgee, Brigalow, Yarran, and having characteristic features that make them easy of determination.

One of the widest spread groups of trees, although not the most numerous, in our forests are the Casuarinas, which, although rarely found on the market, have a most decorative figure, whilst for hardness they must be ranked in the premier class.

A very large area of the interior forest land is occupied by our Australian "Cypress Pines," *Callitris spp.*, and it is, perhaps, doubtful whether or not these should be included in the present work, for they are certainly in a very much higher class of hardness than Conifers of other countries, such as Oregon, Firs, White and Yellow Pine, Redwood, Cedars, &c. They are easy of determination, being immediately recognised by the aroma of the wood.

Some Natural Orders have representatives both in the forest and brush, such as Meliaceæ, Leguminosæ, Proteaceæ.

Except in the case of the latter the few species overlapping in each section does not warrant us in regarding the N. O. as typically forest or brush as the case may be.

II. BRUSH TIMBERS.

The brush timbers of the East Coast of the Continent and Tasmania contain a large number of species, and owing to the fertility of the soil where these brushes exist the growth of trees is so dense that it is only with the greatest difficulty the scrubs are penetrable, and where the botanist, more often than not, is compelled to follow the tracks of the bullock teams of the timber-getters. Hence it will be easily seen how troublesome is the collecting of material for the identification of these timbers.

Thus there are some of them not yet botanically placed, although the timber finds its way to the saw-mills, and thence to the market with not even a common name, and this accounts for the absence of common names to some species in the list of hardwoods given here.

On the other hand, the timber expert, for want of botanical material, is occasionally in a dilemma as to systematic identity of a timber. Consequently, in this category, there are awaiting botanical names to such timber as—

Red Apple from Queensland.
(A beautiful red hardwood.)
Myrtle (? Eugenia Sp.).
Lilly Pilly (not Eugenia Smithii).
Timbuami.
White Rosewood.
Tomi Ticki (? Dysoxylon).
Yellow-wood Teak (? Flindersia Sp.)
Zebrawood.

Brush species differ from the forest species in that there is no dominating group of trees like the Eucalypts as in the latter case, but representatives of the numerous N. O.s are fairly well averaged throughout the brushes. Of course in the wide geographical range covered by the brushes, varieties of trees are found in Queensland which do not occur in New South Wales, and *vice versa*.

The majority of the timbers are hard, but the soft woods are those most generally found on the market, such as Red Cedar, Red Bean, Queensland Maple, Beech, and Pines, whilst amongst the former Teak, perhaps, takes pride of place, followed by Crow's Foot Elm, and Long Jack (Flindersia).

In the brushes we have some of the finest hardwoods in the world, forming excellent substitutes for the old world hardwoods. In view of the new forestry regimé now initiated, it is hoped that an active replanting of such trees as Rutaceæ, Rhamneæ, Sapindaceæ, Saxifrageæ, Laurineæ, Euphorbiaceæ, Verbenaceæ will eventuate.

III. LITTORAL TIMBERS.

These are trees restricted entirely to the sea shore, such as *Avicennia officinalis*, Linn., *Heritiera littoralis*, Ait., *Cynometra ramiflora*, Linn.

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*All those timbers which are milled in quantity and are brought to market are regarded in the trade as Commercial and are marked with an asterisk.

FIG. XVII.

BRUSH COUNTRY.

FIG. XVIII.

Photo. T. Dick.]

LITTORAL TIMBER TREES.

Avicennia officinalis, LINN. GREY MANGROVE.

(*b*) DESCRIPTION OF HARDWOOD SPECIES.
(In Botanical Sequence.)

NATURAL ORDER.

Capparideæ.

This Order has a fairly wide distribution in temperate and tropical regions, but as the species are mostly herbs or shrubs it is not often quoted as yielding timber.

The two recorded here are small trees and do not yield big material, but yet produce a fine hardwood.

Species Illustrated in Colour:—

Capparis nobilis, F.v.M. (Native Orange).

Capparis nobilis, F.v.M.

"NATIVE ORANGE." Plate 1.

TIMBER.

Description and uses.

The characteristic feature of the wood of this species and the congener is its very close texture, palest yellow colour, hard and fairly heavy nature. It planes well, a good face being easily produced, and takes a good polish.

Amongst the world's timbers it should be classed with Box and Lancewood, and, therefore, could be used for any purpose to which these are applied. The tree being of medium height, 50 to 60 feet, naturally the sizes obtainable are not large. It very closely resembles *Sideroxylon australis* in colour and texture.

† H. = Moderate. ‡ W. = 50 lb. per cubic foot.

† H = Hardness, ‡ W = Weight, as explained on Pages 2 and 23 respectively.

ANATOMICAL FEATURES.

It has a very uniform texture, the fibres and vessels as well as wood parenchyma having an almost equal percentage of the wood structure.

The annual rings are comparatively narrow and in undulating circles. The rays are numerous and unicellular and show as very fine lines in transverse sections, the rays being so small no figure is obtained in a radial cut.

Systematic.

A small tree 50 feet to 60 feet high and 1 foot in diameter, with a thin, close, compact, light coloured, slightly wrinkled bark, and short prickles in the branchlets, and a pronounced sapwood readily attacked by borers. Leaves oval-oblong or oblong, 2 to 4 inches long, coriaceous and shining above. Flowers single in the upper axils about 1 inch long. Petals four, white, much larger than the sepals, pubescent inside. Stamens numerous. Fruit about 1 inch in diameter, globular, with a small protuberance at the top, stalk from 1 to 2 inches long. Seeds numerous, embedded in a hard almost woody pulp.

Geographical Range.

Brushes of the New South Wales Coast district, Hunter River to Queensland, Brisbane and Fitzroy Rivers.

Capparis Mitchelli, Lindl.

"NATIVE POMEGRANATE."

TIMBER.

DESCRIPTION AND USES.

The timber of this and its congener are practically identical in physical features, so that the remarks under that species apply here.

H. = Moderate. W. = 51 lb. per cubic foot.

Systematic.

This species differs principally in specific characters from *C. nobilis* in having smaller leaves, larger flowers, and a much larger fruit, about 2 inches in diameter.

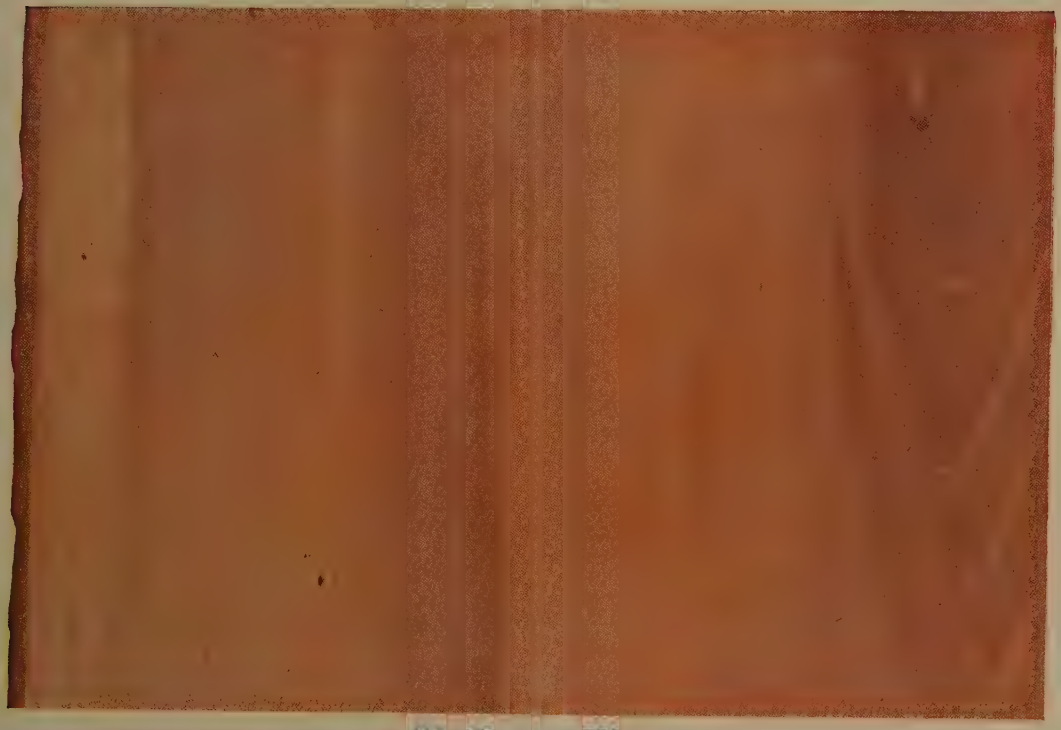
Geographical Range.

This has a much greater range than *C. nobilis*, as it occurs in the interior of all the Eastern States.

PLATE 1.

NATIVE LEMON.
(*Capparis nobilis*, F.v.M.)

PLATE 2.



MOUNTAIN CHERRY.
(*Scolopia Brownii*, F.v.M.)

NATURAL ORDER

Bixineæ.

A LARGE Natural Order distributed over the temperate and tropical countries of the world, but not producing many timber trees. The one mentioned here is endemic to Australia, and there is only one species of any value in this connection.

SPECIES ILLUSTRATED IN COLOUR :—

Scolopia Brownii, F.v.M. (Mountain Cherry).

Scolopia Brownii, F.v.M.

"MOUNTAIN CHERRY." Plate 2.

TIMBER.

DESCRIPTION AND USES.

This is one of the best of the brush timbers, which is faded chocolate in colour, darkening towards the centre, close grained, tough, and hard ; it has little sapwood, and the rays being small, the figure is not prominent.

It is seldom found on the market, but would be suitable for heavy carriage framing, tool handles, &c., and as it partakes somewhat of the character of European Walnut, except a little closer in texture, would make a splendid substitute wherever that excellent wood is used in the commercial world.

H. = Hard. W. = 60 lb. per cubic foot.

ANATOMICAL FEATURES.

The thick-walled fibres are the prominent feature of a transverse section of this wood, in which respect it much resembles a Eucalyptus timber in this view, the lumen being small. The pores are irregularly scattered and fairly numerous, the wood parenchyma being clustered either around them or running in concentric, broken lines. The rays are fairly numerous, uniseriate, and multiseriate, but not very high, some of the cells containing a secretion; they are sometimes bounded top and bottom by vertically celled tracheids. The vessels are numerous, with mostly clear cells.

Systematic.

A medium sized brush tree, with a smooth grey or palish thin bark. Leaves mostly ovate lanceolate from 2 to 4 inches long, petiole about ¼ inch long, entire or crenate, subcoriaceous, sometimes shining above, reticulation distinctly marked, occasionally with marginal glands, triplinerved. Flowers in small short axillary racimes or in a terminal panicle. Fruit, a berry, with two or four hard seeds.

Geographical Range.

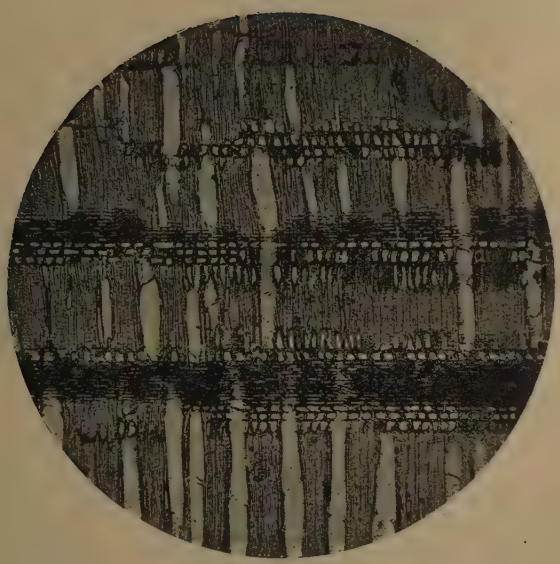
The brushes of the East Coast, north of the Illawarra District.

MICROPHOTOGRAPHS.

These show a magnification of about 45 diameters, except in a few higher instances.

FIG. XIX.

CROSS SECTION, showing band of late wood running obliquely across the section; pores in early wood, and rays in dark lines.



Micro. photo.]

RADIAL SECTION, showing heterogeneous rays, the dark inner cells containing a brown deposit; compact masses of fibres, and vessels.

[*T. C. Roughley.*

TANGENTIAL SECTION, showing dark end of rays, vessels, fibres, and wood parenchyma.

SCOLOPIA BROWNII, F.v.M.

"MOUNTAIN CHERRY."

NATURAL ORDER.

Pittosporeæ.

THIS is a very limited Natural Order, the genus Pittosporum being the only one occurring outside Australia. It is not a great timber-yielding group; the species are mostly distinguished by an aromatic resinous bark, and fragrant flower in the evenings of Spring. The trees of timber dimensions average from 60 to 90 feet high with a proportionate diameter.

SPECIES ILLUSTRATED IN COLOUR:—

Pittosporum undulatum, Vent. (White Holly.)

Pittosporum rhombifolium, A. Cunn.

"WHITE HOLLY."

TIMBER.

DESCRIPTION AND USES.

This is one of our best timbers for firmness of grain and texture, consequently it works up with a smooth surface, exactly like English Box (*Buxus sempervirens*), and for which, like its congeners, it is an excellent substitute. It is very pale yellow in colour, with a silvery sheen on a planed surface; close grained, tough, rather hard. Considered suitable for carving and engraving; makes a nice inlay timber for marquetry, and a first-class wood for golf heads. No sapwood, seasons well; the figure is very small.

H. = Hard. W. = 50 lb. per cubic foot.

Systematic.

A fair sized tree with a non-resinous, yellowish bark. It is easily distinguished from its congeners by its rhomboidal leaves, coarsely and irregularly toothed on the upper edges, and narrowed into a petiole, under 4 inches long, coriaceous and shining with an almost parallel venation prominent on both sides. Flowers white or creamy, numerous, small in a terminal cluster (corymb). Capsule more or less pear-shaped or almost globular, under ½ inch long with a few black seeds.

Geographical Range.

With the exception of *P. phillyræoides*, which is an interior tree, they are all found in the East Coast brushes.

Pittosporum undulatum, Vent.

Plate 3.

TIMBER.

Description and Uses.

See remarks under *P. rhombifolium*, as the timbers are almost identical and would serve the same purposes.

H. = Hard. W. = 56 lb. per cubic foot.

Anatomical Features.

The pores have a comparatively small diameter, and the wood parenchyma is very limited. A crystalline deposit of monoclinic crystals, plates or short prisms of calcium oxalate, was seen in some of the cells of the ray parenchyma which have very delicate walls, otherwise the wood elements were free of any deposit. The rays are of the heterogeneous type and have fairly thick walls; the unusually large wall markings of the vessels are a distinct feature of this species. The fibres are numerous with few, exceedingly minute wall perforations.

Systematic.

A tree of fairly large dimensions in its native habitat—the brushes of the East Coast of New South Wales and Victoria—with resinous, dark coloured bark. Leaves ovate or oval-oblong, acuminate, up to 6 inches long, undulate on the margins, subcoriaceous, slightly shining, venation not well marked, upper ones with a tendency to whorl. Flowers white and aromatic in the evenings of early spring in terminal clusters, much shorter than the leaves, about ½ inch long. Capsule nearly globular, ½ inch in diameter; smoothish, with numerous seeds.

Geographical Range.

The East Coast brushes of New South Wales and Victoria.

Pittosporum ferrugineum, Ait.

TIMBER.

Description and Uses.

Similar character and uses as *P. rhombifolium*.

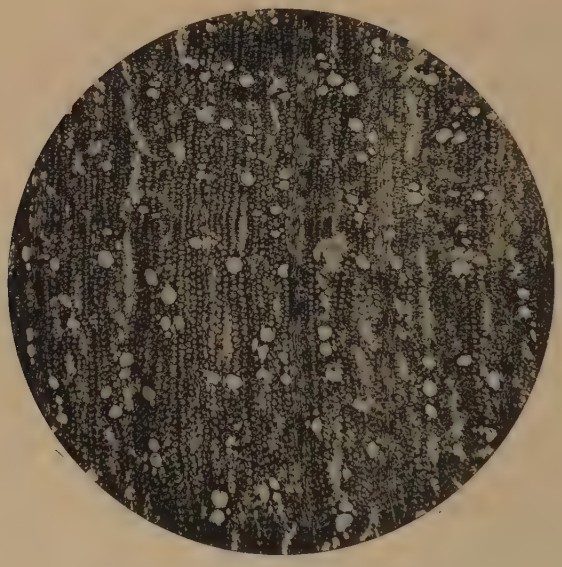
Systematic.

A medium sized tree, with a rusty tomentum on the young shoots. Leaves obovate-ovate, oblong to lanceolate, 3 to 4 inches long, entire, rusty tomentum on both sides when young. Flowers at the ends of the branchlets. Capsule sessile, globular or nearly so, ½ inch broad with three of four black seeds.

Geographical Range.

It has a wide East India distribution, in the Malay Peninsular and Philippines, but in Australia is restricted to Queensland,—Endeavour River, and a few neighbouring islands.

FIG. XX.



CROSS SECTION, showing small pores irregularly distributed, and predominance of fibres in radial rows.

Micro. photo.]

RADIAL SECTION, showing rays—crystals are seen in the cells on the extreme right; compactness of fibres and few vessels.

[*T. C. Roughley.*

TANGENTIAL SECTION, showing rays one to three cells wide and several cells high. Only portions of a few vesseis are seen and no wood parenchyma.

PITTOSPORUM UNDULATUM VENT

Hymenosporum flavum, F.v.M.

"WOLLUM WOLLUM."

TIMBER.

DESCRIPTION AND USES.

Wood whitish, close grained and tough. No sapwood. Figure similar to White Holly, *Pittosporum rhombifolium*. Seasons well, easy to work. Suitable for small cabinet work.

H. = Moderate. W. = 43 lb. per cubic foot.

Systematic.

A fine upstanding medium sized tree with a pale coloured bark, non-resinous. Leaves ovate oblong or oblanceolate, up to 6 inches long. Flowers yellow in colour, highly perfumed, largest of the genus, in terminal panicles, sepals about ¼ inch long, petals silky tomentose outside the erect base over 1 inch long and the spreading portions ½ inch long. Capsule flattened, about 2 inches long, seeds numerous, flat, piled on each other like small coins.

Geographical Range.

The brushes of the East Coast of New South Wales and Queensland.

Bursaria spinosa, Cav.

"BOX THORN."

This genus is endemic, and the one species here described is the only one so far recorded.

TIMBER.

DESCRIPTION AND USES.

A smaller tree than the previous species, but the same remarks apply as regards the economics and physical characters.

H. = Hard. W. = 51 lb. per cubic foot.

Systematic.

Generally a prickly shrub or small tree, sometimes reaching a height of 40 feet, with a rough deeply fissured black bark. Leaves very variable from ½ to 2 inches long, and of nearly every shape. Flowers white in profusely terminal panicles. Capsule ¼ inch long, flat, broadly orbicular, opening round the edges with thin coriaceous flat valves.

Geographical Range.

Throughout Australia and Tasmania.

NATU AL ORDER.

Sterculiaceæ.

As a rule this Natural Order in other parts of the world is very poor in its timber production, but one or two of the Australian representatives seem to be an exception in this respect to the rule.

There is one endemic genus, *Tarrietia*, which produces hard timbers, and in the case of *T. argyrodendron*, the timber is fairly heavy, with an attractive specific character. It is known locally as Ironwood, or Crowsfoot Elm, and was at one time much more in demand than at present—defective seasoning causing it to be discarded.

Species Illustrated in Colour :—

Tarrietia argyrodendron, Benth. (Crowsfoot Elm).

*Tarrietia argyrodendron, Benth.

"CROWSFOOT ELM." Plate 4.

TIMBER.

Description and Uses.

This is a well-known timber of the trade, especially of New South Wales and Queensland. It is a medium brush tree possessing a chocolate-coloured, straight grained, tough, and firm timber, with darker heart-wood. In order to obtain the best effect this timber should be cut radially, which gives a figure somewhat resembling Grevilleas and other Proteaceous timbers, seasons quickly, but is liable to deteriorate rapidly if left in the log. Its chief character is a neat, very pretty silver grain, the medullary rays being numerous and well marked, as seen in the plate here given; medium weight, rather open in the grain, dresses well and takes a good polish. It has been used for interior panelling in some of the Queensland Railway carriages, being suitable for most kinds of inside decorative work, especially railway passenger cars and ship's cabins, also for brush backs, ornamental boxes, turnery, furniture, &c.

H. = Moderate. W. = 52 lb. per cubic foot.

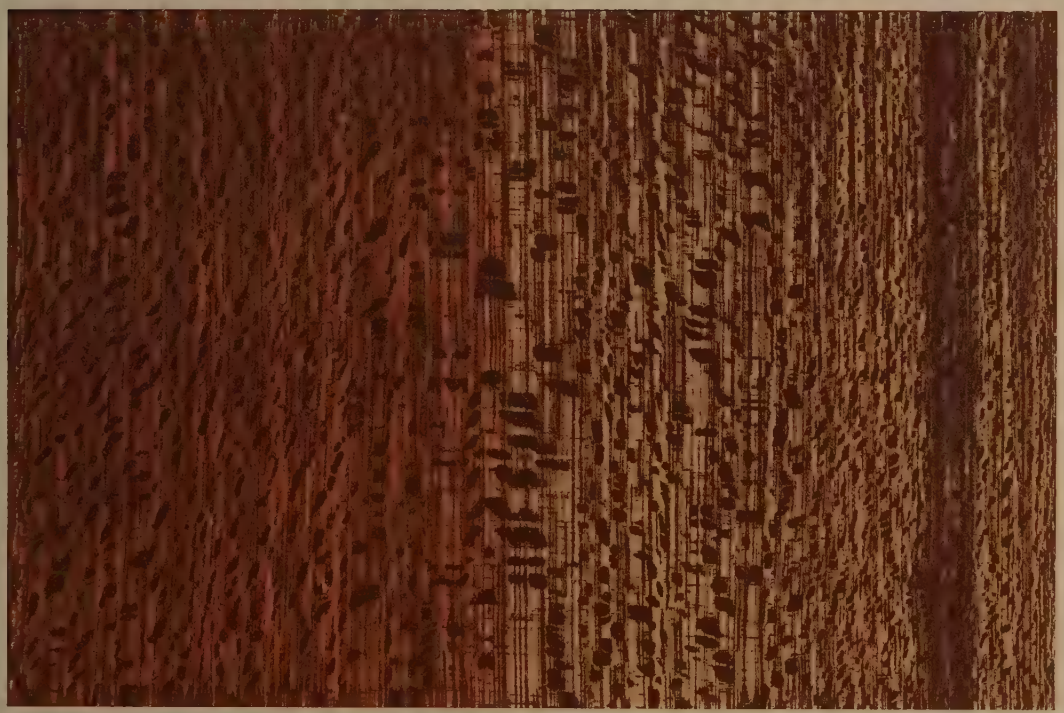
*All those timbers which are milled in quantity and brought to market may be regarded as Commercial and are marked with an asterisk.

PLATE 3.

PITTOSPORUM.

(*Pittosporum undulatum*, ANDR.)

PLATE 4.



CROW'S FOOT ELM.

(*Tarrietia argyrodendron*, BENTH.)

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timbers of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load, lb.	8,000	7,400	8,000
Modulus of rupture in lb. per square inch ...	18,060	14,473	14,348
,, elasticity ,, ,, ...	.....	.....	.....
Rate of load in lb. per minute	727	493	800

ANATOMICAL FEATURES.

The two main characteristics of the anatomy of this timber are the disposition of the wood parenchyma and the presence of a brown deposit in its cells as well as that of the rays. It is not unlike some of the Grevilleas and *Orites excelsa* in having fibres and parenchyma arranged in alternating concentric bands. The fibres are thick-walled leaving very little space for the lumen, and perforations appear to be almost entirely absent. The vessels are rather large and mostly clear of tyloses, and around them wood parenchyma occurs as well as in the position stated above. The predominating rays belong to the multiseriate class, and in a radial section are seen to be heterogeneous, the outer row of cells containing monoclinic crystals, plates, or short prisms of calcium oxalate.

Systematic.

A large, erect tree, the stem often exceeding 5 feet in diameter. Leaves trifoliate, the petioles somewhat angular, mostly 2 to 3 inches long. Leaflets lanceolate, from 4 to 7 inches long, and from 1 to 2 inches broad towards the middle, the indumentum more silvery than usual in this genus, but with the same numerous small brown scales. Carpels muricate, oval or globose, ½ to ¾ inch long by about ½ inch diameter furnished with an oblong, oblique, erect wing 2 to 4 inches long by about 1¼ inch broad, clothed with the same rusty, stellate scales as the under side of the leaves.

Bailey. Queensland Flora, vol. 1 p. 140 describes five varieties of this tree, viz. :—

1. Var. grandiflora.
2. ,, angustifolia.
3. ,, macrophylla.
4. ,, trifoliolata.
5. ,, peralata. Johnstone River Red Beach.

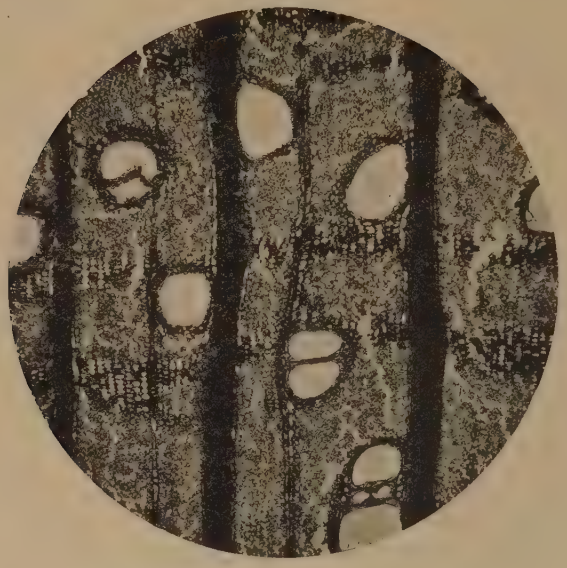
(1) No data as to nature of timbers available.
(2) Wood of a light-grey colour, close grained, hard and tough, suitable for making tool handles.
(3) Wood light-coloured, prettily figured, tough and firm.
(4) Wood similar to the foregoing kinds, but rather darker; known as "stavewood."
(5) Wood resembling cedar in appearance, but harder, suited for indoor and cabinet work.

As I have never had botanical material of these or distinct specimens of timber I am unable to express an opinion on their hardwood value.

Geographical Range.

North Coast of New South Wales and South Coast of Queensland.

FIG. XXI.



CROSS SECTION, showing three broad and two narrow rays. In the former, a brown deposit gives them the black appearance. The wood parenchyma is seen to alternate with bands of fibres, the brown deposit being seen in many of the cells. The large pores are a conspicuous feature.

Micro. photo.]

RADIAL SECTION, showing the brown deposit in both the wood parenchyma and the rays. The fibres are seen to be very compact.

[*T. C. Roughley.*

TANGENTIAL SECTION, showing portions of a large ray, and a few small ones, all separated by wood fibres on the left and a vessel and much wood parenchyma on the right.

TARRIETIA ARGYRODENDRON, BENTH.

"CROWSFOOT ELM."

Tarrietia actinophylla, Bail.

"IRONWOOD."

TIMBER.

DESCRIPTION AND USES

This timber has the reputation of possessing the *Fraxinus* (Ash) qualities, but so far no reliable data are available as to its suitability in the various timber trades. It is subject to borers.

H. – Hard. W. = 60 lb. per cubic foot.

Systematic.

A large tree differing from the previous species in having three to nine leaflets, also the leaflets, petioles, inflorescences, and fruits larger than in that species.

Geographical Range.

Brushes of the North Coast district of New South Wales, and South Coast District of Queensland.

Heritiera littoralis, Ait.

TIMBER.

DESCRIPTION AND USES.

The species of this genus number only two and they are tropical trees—one being found in Australasia.

The wood of the Queensland tree is firm, close grained, and dark coloured; but in India, where it is known as "Sundri," is considered durable, tough, and heavy, and used extensively in boat building, buggy-shafts, and furniture.

Systematic.

A tree attaining a considerable size. Leaves very shortly petiolate, oval or oblong, the larger ones fully 8 inches by 4 inches, but often much smaller, quite entire, coriaceous, glabrous above, silvery underneath, with a close scaly tomentum. Flowers small, numerous, in loose tomentose panicles in the upper axils much shorter than the leaves. Calyx about 2 lines long. Staminal column in the males, pistil in the females, much shorter than the calyx. Fruit carpels sessile, ovoid, 2 to 3 inches long, thick and almost woody, with a slightly projecting inner edge, and a strong projecting almost winged keel along the outer edge.

Geographical Range.

The North-east Coast of Queensland, and widely dispersed over the sea-coasts of Tropical Asia.

NATURAL ORDER.

Tiliaceæ.

THE common Lime or Linden of Europe is a well-known tree of this Order. In Australia its best representatives are all or nearly all soft timbers, but two exceptions are here given.

Elæocarpus obovatus, G.Don.

"WHITE WOOD."

TIMBER.

DESCRIPTION AND USES.

A moderately hard timber, pale in colour, with medium close, slightly interlocked grain. The annual rings are not pronounced. The medullary rays are very fine, which give the wood a very pretty small silver grain, and so it should be acceptable as a cabinet timber. It could be used for coach and carriage body work, turning, and doors, dado-framing, panelling, or most other branches of the joinery trade.

H. = Moderate. W. = 44 lb. per cubic foot.

Systematic.

A tree attaining 60 feet; glabrous in all its parts. Leaves from oval-elliptical to obovate-oblong or almost lanceolate, obtuse or obtusely acuminate, 2 to 4 inches long, irregularly sinuate crenate, narrowed at the base, thinly coriaceous, the smaller veins much less numerous and less conspicuous than in *E. cyaneus*. Racemes solitary or clustered, many-flowered, but shorter than the leaves. Flowers small, white. Sepals acute, 1½ line long. Petals rather longer, divided to about the middle into about seven linear obtuse lobes. Anthers short, obtuse or scarcely pointed. Ovary glabrous, two-celled, with four ovules in each cell. Drupe globular or ovoid, often blue, the putamen rugose, or tuberculate.

Geographical Range.

North Coast of New South Wales and South Coast of Queensland.

Elæocarpus Bancroftii, F.v.M. et Bail.

"EBONY-HEART OF CAIRNS."

TIMBER.

DESCRIPTION AND USES.

Bailey states, Q. Fl., Vol. I, p. 162, that the wood is hard and durable, resembling the American Lignum-vitæ, and might serve for the same purposes.

Systematic.

A large handsome tree, often attaining more than 100 feet in height, with a diameter of more than 2 feet of stem. Leaves clustered at the ends of the branches, ovate obovate or lanceolate, 2 to 4 inches long. Flowers in lateral or axillary umbel-like racemes, bearing at the summit three to five rather large flowers, with often one or two lower down the stalk; pedicels about 5 lines long, Sepals four, valvate, oblong or lanceolate, about 5 lines long and 2 lines broad. Petals four, broadly cuneate, about 7 lines long and 6 lines broad at the top, which is wavy and lobed with three short obtuse lobes. Stigma small. Drupe velvety, ovoid or nearly globular, about 1¼ inch diameter; in drying, when fully ripe, the thin epicarp readily separating from the mealy, rather thick sarcocarp, this also separating freely from the hard smooth-pitted putamen; putamen thick, but the four cells prominently marked, three of which are abortive; thus the fruit contains but a solitary seed, which resembles the kernel of a peach-stone, has an agreeable flavour, and is eaten by the settlers. (Bailey.)

Geographical Range.

Queensland; Johnstone River district, and other tropical hill-side scrubs.

58699—D

NATURAL ORDER.

Rutaceæ.

This Natural Order is quite Southern in its distribution, and as a timber yielder is not famous outside of Australia, but here the material to be obtained from the Rutaceæ is deserving of far more attention than has yet been given it. The genera Bosistoa, Melicope, Pentaceras, Evodia, and Zanthoxylum produce beautifully pale-coloured or even whitish timbers. It is to be regretted that groups of such fine woods should be so near extinction, and their propagation is a national forestry desideratum. Four are colour-photographed here as representative of this fine family of trees.

Although suitable for cabinet woods, these timbers must rank as hardwoods especially *Geijera Muelleri*, Axe-breaker, *Geijera salicifolia* Ironwood, Halfordia, and many others, all being close-grained, and in the case of the Axe-breaker and Ironwood interlocked. Pale yellow is the prevailing colour of most of the woods, only a few being dark. The bulk of their woods make excellent substitutes for English Box and Hornbeam, especially the former, and a good common name for this group of trees would be Australian Boxwood.

Species Illustrated in Colour:—

Geijera salicifolia, Schau (Ironwood).
Geijera Muelleri, Benth (Axe-breaker).
Zanthoxylum brachyacanthum, F.v.M. (Thorny Yellow-wood).
Pentaceras australis, Hook.f. (Scrub Hickory).

Bosistoa sapindiformis, F.v.M.

"UNION NUT."

TIMBER.

Description and Uses.

This species yields one of the finest timbers of the Australian brushes. It is very close, compact, straight grained, hard, and of a pleasing yellow colour, with hair-like brown streaks running through it, which, of course, enlarge when cut tangentially. It would make

a splendid substitute for English Box, and much resembles *Sideroxylon australe* in colour and texture. It is eminently suited for machine bearings and wherever strength is required; and also it should be most effectual for interior decoration, especially for yellow-wood veneers, brush backs, &c.

H. = Hard. W. = 54 lb. per cubic foot.

Systematic.

A tree with the habit of a Cupania, the young shoots, petioles and inflorescence minutely pubescent. Leaves pinnate, leaflets 7 to 11, opposite in pairs, the terminal odd one occasionally wanting, oblong-lanceolate 4 to 8 inches long, more or less serrate-toothed, especially above the middle, narrowed at the base on a short petiolule or nearly sessile. Flowers in terminal panicles, trichotomous, shorter than the leaves. Cocci broadly and very obliquely ovate, about 1 inch long, hard, almost woody, tomentose and rugose outside.

Geographical Range.

Brushes of the North Coast of New South Wales and South Coast of Queensland.

Bosistoa euodiformis, F.v.M.

TIMBER.

Description and Uses.

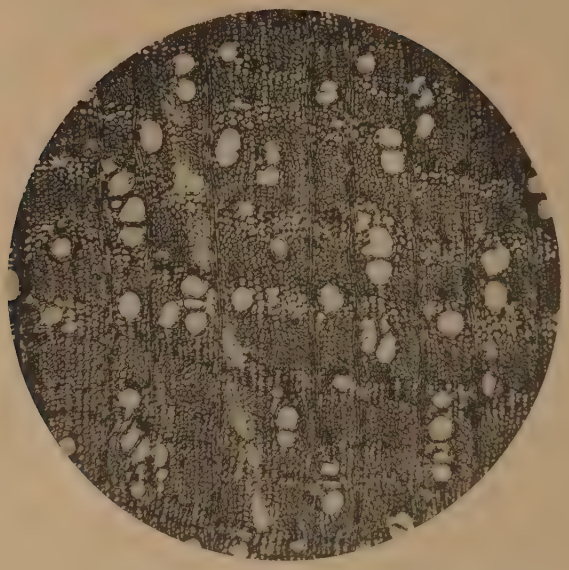
This, like its congeners, yields a splendid forest log, the timber is close in the grain, hard, of a greasy nature, yellow with brown streaks. Planes to a very fine smooth surface; it is a good substitute for English Box, and could be used for the same economic purposes as *B. sapindiformis*.

H. = Hard. W. = 56 lb. per cubic foot.

Anatomical Features.

A very interesting timber microscopically, more particularly radially and tangentially, when the specific differences from its congeners are most marked. In a cross section the fibres are seen to be arranged in comparatively regular order, broad bands alternating with parenchyma bands, both broad and narrow; the pores are numerous and irregularly scattered amongst the other wood elements; whilst the rays are fairly numerous, the radial view showing them with a single band of slightly vertical cells bordering the mass of narrow elongated cells. The vessels and the wood parenchyma mostly are free from any

FIG. XXII.



CROSS SECTION, showing bands of thick-walled fibres, alternating with bands of thin-walled wood parenchyma. The thick-walled pores are often conjugate; the rays are fine and not too clearly discernible

Micro photo.]

RADIAL SECTION showing full height of rays; chambered wood parenchyma (right of centre). Crystals on the extreme right.

[*T. C. Roughley.*

TANGENTIAL SECTION, showing ends of uniseriate and multiseriate rays, chambered wood parenchyma, fibres (compac portion), and portions of a few open vessels.

BOSISTOA EUODIFORMIS, F.v.M.

amorphous deposit, but occasionally is found a special form of parenchyma or crystal sac, in which are seen crystals of the monoclinic type, as described under *Tarrietia argyrodendron*. The wood parenchyma has rather shorter cells than obtain in most of the Angiosperms, whilst the ray cells are also exceptionally narrow. The rays are of the uniseriate and multiseriate variety, and the radial perforations are very numerous in parallel and horizontal lines. The fibres are thick walled with a lumen so narrow that it is impossible to detect the perforations.

Systematic.

A typical brush tree with a smoothish pale yellow-coloured bark, with triplicate compound leaves; leaflets thin, oval, lanceolate, pale underneath, edges slightly denticulate or entire. Flowers small, white, in terminal panicles shorter than the leaves. Calyx five, deeply lobed. Petals five, valvate, or nearly so. Fruits not known.

Geographical Range.

The Clarence River district of New South Wales to the Southern Brushes of Queensland Coast.

Bouchardatia neurococca, Baill.

TIMBER.

DESCRIPTION AND USES.

A small brush tree which yields a timber resembling somewhat in texture and colour *Bosistoa sapindiformis;* is very hard and close grained, of a uniform light yellow colour, darkening in the annual ring, but closer in the grain than *B. sapindiformis.* It is tough to work, and should be suitable for tool handles or for any purpose where a hard wearing timber of small dimensions is required.

H. = Extremely hard. W. = 69 lb. per cubic foot.

Systematic.

A small tree, the young branches petioles and peduncles pubescent with simple spreading hairs. Leaves of each pair generally unequal, the larger one with a common petiole of 2 inches or more, the other with a much shorter petiole; leaflets three, ovate-lanceolate or lanceolate, acuminate, mostly 3 to 4 inches long, glabrous above, sprinkled with a few hairs underneath. Flowers small in panicles, terminal, trichotomous, corymbose. Cocci distinct, nearly erect, broad, about 3 lines long, the valves coriaceous and transversely wrinkled.

Geographical Range.

The brushes of the North Coast of New South Wales, and the South Coast of Queensland.

Melicope erythrococca, Benth.

TIMBER.

DESCRIPTION AND USES.

A species yielding a beautiful timber of a light canary colour with an exceedingly small figure; very close, even, straight grain; one superior in its special qualities to English Box, whilst much greater sizes can be secured free from knots than obtain in the European Buxus species. It has a rather pretty little figure when cut on the ray. A splendid tree for reafforestation.

H. = Very hard. W. = 59 lb. per cubic foot.

Systematic.

A moderate sized tree, quite glabrous. Leaflets three or rarely one only, oblong, lanceolate, obtuse, 1½ to 3 inches long, coriaceous, entire or obscurely crenulate on a common petiole ¾ to 1½ inch. Flowers very small in panicles terminal or in the upper axils loose, scarcely longer than the leaves. Cocci four or very rarely five very spreading, ovate, about 2 lines long, wrinkled, of a reddish colour.

Geographical Range.

The Coast districts of Queensland and New South Wales.

Melicope australasica, F.v.M.

"SOAPWOOD."

TIMBER.

DESCRIPTION AND USES.

This is another Rutaceæ tree of our Australian brushes yielding a splendid timber, slightly more open in the grain than *M. erythrococca* but otherwise similar in colour and figure. The two timbers could be used for almost the same economic purposes; this tree, however, grows to much larger dimensions, and is one that should be reafforested without delay, as it is fast disappearing.

H. = Moderate. W. = 41 lb. per cubic foot.

Systematic.

A handsome tree, glabrous in all its parts. Leaves digitately three-foliolate, the petiole several times shorter than the leaflets; leaflets oblong-elliptical, or rarely obovate-oblong, obtuse or shortly acuminate, 6 to 10 inches long, somewhat coriaceous, entire. Flowers small under ¼ inch long, panilces axillary, trichotomous, loose and many flowered, but much shorter than the leaves. Carpels nearly glabrous, but tapering into strictly terminal short pubescent styles united at the summit. Cocci erect, distinct, angular, acuminate, not 2 lines long. Seeds shining.

Geographical Range.

The brushes of the North Coast of New South Wales, and of the South Coast of Queensland.

Evodia micrococca, F.v.M.

"WHITEWOOD."

TIMBER.

DESCRIPTION AND USES.

A fairly large brush tree, possessing a timber rather more open in the grain than the Melicopes, but otherwise it is a good duplicate. The wood is of a light-yellow colour, close in grain and tough, and inclined to be interlocked. An excellent substitute for English Box, and useful for similar purposes as the Bosistoa species.

H. = Moderate. W. = 44 lb. per cubic foot.

Systematic.

A tree of considerable size, quite glabrous. Leaves digitately three-foliolate with long petioles; leaflets obovate-oblong, obtuse, mostly 1½ to 3 inches long, entire, narrowed at the base, the central one almost petiolulate. Flowers in dense cymes or trichotomous panicles on short lateral peduncles below the young shoots. Cocci not 2 lines long, not separating so completely as in the Melicopes, rugose-glandular outside. Seeds black and shining.

Geographical Range.

The brushes on the North Coast of New South Wales and the South Coast of Queensland.

Evodia zanthoxyloides, F.v.M.

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey states, Q. Fl., Vol. I, p. 200, that the wood of this tree is hard, heavy, scented, and of a yellowish colour.

Systematic.

An average brush tree with a smooth bark, with opposite trifoliate leaves and with petioles 5 to 6 inches long. Leaflets entire 6 to 10 inches long, thin in texture, sessile, ovate, glabrous above, leaves on underside pubescent. Flowers in cymes, small. Fruit separating into two, coriaceous two valved cocci, subovate, turgid, very obtuse, 3 to 4 lines long, glabrous, inside pubescent. Seeds dark-brown, shining, 2 lines long.

Geographical Range.

North Coast brushes of New South Wales and South Coast of Queensland.

Geijera salicifolia, Schott.

"IRONWOOD." Plate 5.

TIMBER.

DESCRIPTION AND USES.

A fair-sized brush tree with a lightish-coloured comparatively smooth bark. The timber is exceedingly close in the grain, very hard and heavy, and of a pale yellowish colour, mixed with a light brown tint, with a dark heart-wood. Suitable for constructional works where weight, hardness, and durability are the desiderata, such as bridges, wharves, frame work of heavy carriages, trucks, waggons, machinery blocks, &c. It is difficult to dress.

H. = Hard. W. = 61 lb. per cubic foot.

Systematic.

This species differs from *G. Muelleri*, in having valvate petals, and a loose panicle of flowers and narrow leaves.

Geographical Range.

The brushes of the North Coast, New South Wales, and brushes of Queensland.

Geijera Muelleri, Benth.

"AXE-BREAKER." Plate 6.

TIMBER.

DESCRIPTION AND USES.

This is an exceedingly close-grained timber, with a rather interlocked fibre, having a pale yellow-brown coloured ground, with whitish streaks. Its close, compact nature makes it eminently suited for machine-bearing, and constructional works requiring great strength. It could be used for heavy carriage frames, goods trucks, mauls, &c. This species has a timber very much of the nature and colour of *Sideroxylon australe*, and, like that species, has a greasy nature.

H. = Extremely hard. W. = 78 lb. per cubic foot.

Systematic.

A good average brush tree with a smoothish bark. Leaves alternate, single, not articulate in the petiole, ovate, or obovate-oblong, 2 to 3 inches long, narrowed into a rather long petiole, coriaceous with a prominent midrib, the lateral veins distinct and not well marked, broad in comparison with *Geijera* species. Flowers very small in a compact panicle about the size of the last leaves. Petals imbricate. Fruit dividing into distinct cocci 2 to 3 lines long spreading but adnate at the base. Seeds hard, shining, chocolate colour.

Geographical Range.

North Coast district of New South Wales and South Coast of Queensland.

PLATE 5.

IRONWOOD.
(*Geijera salicifolia*, SCHAU.)

PLATE 6.

AXE BREAKER.
(*Geijera Muelleri*, BENTH.)

Geijera parviflora, Lindl.

"WILGA."

TIMBER.

DESCRIPTION AND USES.

This is a timber of equal merit to other *Geijeras*, but with a darker centre thus much resembling *Lignum vitæ*, for which it would make a good substitute, and is in general use as a hardwood in the localities in which it is found. F. M. Bailey states that when freshly cut it possesses an agreeable fragrance.

H. = Very hard. W. = 64 lb. per cubic foot.

Systematic.

It differs from the two other species here enumerated, principally in having narrower leaves.

Geographical Range.

Mostly an interior species found in all the States except Tasmania.

Zanthoxylum brachyacanthum, F.v.M.

"THORNY YELLOW-WOOD." Plate 7.

TIMBER.

DESCRIPTION AND USES.

This is a species that is not usually found on the market owing to its rarity, but deserves attention from foresters as a brush tree for propagation. The timber has a canary-yellow colour, is hard, close grained, and seasons well, is fairly heavy, and takes a good polish. It is strong and durable, and would be useful for articles of furniture or ornamental work where these qualities are required. It is also suitable for railway waggons, buggies, parts for boat-building, veneers, picture frames, &c.

H. = Moderate. W. = 48 lb. per cubic foot.

Systematic.

This is a brush tree of average dimensions, the bark on the trunk and branches being covered with short conical thorns. Leaves alternate pinnate, the common petiole being sometimes a foot long, leaflets 9 to 13, opposite petiolate, shining, almost membraneous, sometimes serrulate or crenate, shining, 2 to 3 inches long, ovate to oblong elliptical, glabrous. Flowers in short axillary panicles, the male flowers nearly 3 inches long, the female much shorter. Fruit, one to five distinct cells, dry or drupaceous, usually two-valved.

Geographical Range.

Brush forests, Southern Ranges, Queensland, to the Clarence River, New South Wales.

Zanthoxylum veneficum, Bail.

"POISON TREE."

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey states, Q. Fl., Vol. I, p. 204, that this timber is of a yellowish colour, close in the grain, yet easy to work.

Systematic.

A medium sized tree, glabrous, the branches and sometimes the stem prickly. Leaves (including the petiole) from 6 to 12 inches long. Leaflets 5 to 9, opposite in pairs, with or without a terminal odd one, petiolulate, oblong-lanceolate, shortly acuminate, unequally sided at the base, 3 to 6 inches long, 1 to 2 inches broad, the primary veins prominent, almost transversely spreading, prickles none or scarcely any on the rhachis, petiolule 1 or costules. Flowers small in threes or fours at the ends of the branchlets of the panicle which are terminal and in the upper axils, trichotomous. Pedicels short.

Geographical Range.

The North Queensland Coast.

Medicosma Cunninghamii, Hook.f.

"GLUE GUM."

TIMBER.

DESCRIPTION AND USES.

A good average brush tree, yielding a splendid, light-coloured, very close-grained timber. It has a dark brown heart-wood, very fine annual rings; hard, tough to dress with hand planes. It should make good tool handles, and is a good cabinet-maker's wood, particularly for heavy cabinet work, as well as having other economic uses.

H. = Hard. W. = 54 lb. per cubic foot.

Systematic.

An average tree with a thin yellowish fairly smooth bark, and having mostly opposite leaves, obscurely articulate on the petiole, oblong-elliptical, obtuse or acuminate, up to 6 inches long, subcoriaceous in some cases lighter on underside. Flowers large in axillary panicles, trichotomous, with large flowers. Sepals orbicular, 2 to 3 lines long with a midrib. Petals nearly ¾ inch long, broadly ovate, with prominent midrib. Fruit separating into two distinct two-valved cocci.

Geographical Range.

North Coast district of New South Wales and South Coast district of Queensland.

Pentaceras australis, Hook.f.

"SCRUB HICKORY." Plate 8.

TIMBER.

Description and Uses.

In some respects this might be regarded as a substitute for English Hornbeam, although it does not possess the pronounced ray of the latter. The tree grows to a fair average size, and so produces a timber of sufficient dimensions for general use and cabinet work; it is hard, fairly close grained, pale yellowish in colour, dresses well and takes a fine polish, which brings out a natural sheen not shown by planing. It would make into heavy furniture in light coloured suites; looks well in panelling, and, in fact, is suitable for any class of cabinet work where strength and durability are required combined with an attractive appearance. A tree strongly recommended for forest culture, as it yields an all-round excellent timber.

H. = Hard. W. = 54 lb. per cubic foot.

Anatomical Features.

The texture of this timber is of a particularly even nature, the fibre being of a uniform diameter, and having a lumen about half the diameter of the whole; they run in regular medullary rows, and with apparently no perforations.

Concentric bands of wood parenchyma separate much thicker bands of fibres; the ray parenchyma is of the heterogeneous type and fairly numerous, uniseriate and multiseriate in width, but not many cells high.

The vessels are fairly well scattered throughout, and are conjugate, seldom single, and occasionally contain a brown secretionary substance in the cells.

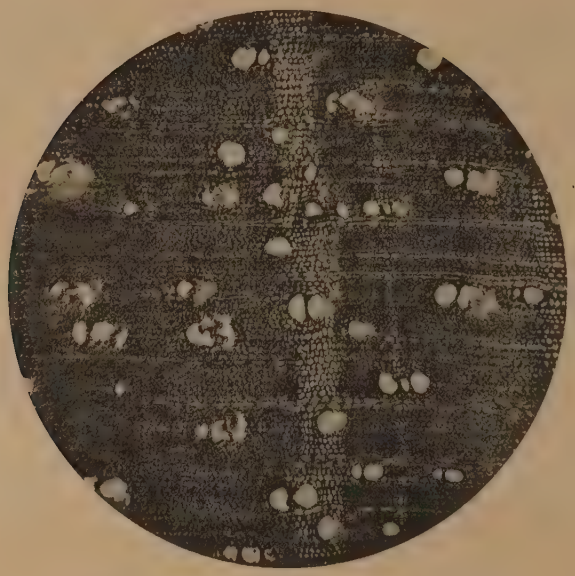
Systematic.

An average sized tree of the scrub of the middle eastern coast districts of Australia. Leaves pale on the underside, pinnate with a petiole ranging in length up to a foot; leaflets from six to twelve, in opposite pairs, and a terminal one, ovate to lanceolate, obtuse or acuminate, up to 6 inches long, edges entire, rarely finely crenate, sometimes decurrent on the lower edge. Flowers in large panicles on the ultimate branches, often exceeding the leaves. Petals and stamens very small. Fruit a samara, ½ to 2 inches long, up to ¾ inch broad.

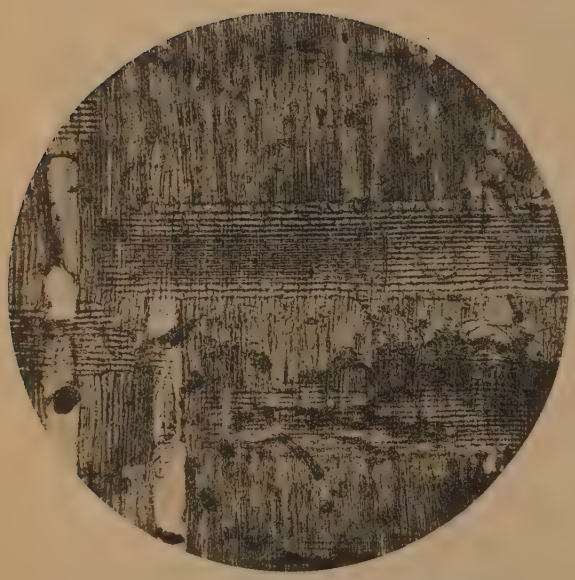
Geographical Range.

Brush forests of Southern Queensland to Richmond River, New South Wales.

FIG. XXIII



CROSS SECTION, showing two broad and one narrow, bands of thin-walled wood parenchyma; compact radial rows of very small fibres; pores irregularly distributed throughout; rays as light lines.



RADIAL SECTION, a long heterogeneous ray above the middle; portions of two vessels (lower left); and compact masses of fibres.

TANGENTIAL view of rays and fibres and vessel.

PENTACERAS AUSTRALIS, J HOOKER.

"SCRUB HICKORY."

PLATE 7.

THORNY YELLOW WOOD.
(*Zanthoxylum brachyacanthum*, F.v.M.)

PLATE 8.

SCRUB HICKORY.
(*Pentaceras australis*, J. Hook.)

Acronychia Baueri, Schott.

"BRUSH ASH" OR "YELLOW WOOD."

TIMBER.

DESCRIPTION AND USES.

This wood has the facies of most of those of the Natural Order. It is heavy, hard, close grained, dresses and planes well. It is yellow in colour, and so would be suitable for some forms of cabinet work, but is especially adapted for coach and waggon framing, certain parts of ship building, joinery purposes, and is a splendid timber for tool handles, planes, and other trades requiring such a textured timber.

H. = Hard. W. = 53 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	8,770	10,300
Modulus of rupture in lb. per square inch ...	18,077	21,375
,, elasticity ,, ,, ..	2,172,500	2,515,500
Rate of load in lb. per minute	974	1,030

Systematic.

An average brush tree with a pale coloured bark. Leaves opposite, and foliate, on a rather long petiole, ovate elliptical or obovate obtuse, or very shortly acuminate, with a length up to 5 inches, subcoriaceous. Flowers few, white or yellowish in colour, in very short axillary panicles. Petals ovate, about 2 lines in length. Fruit nearly globular or four-angled, obtuse or shortly acuminate, ½ inch in diameter, slightly succulent. Seeds very hard and black.

Geographical Range.

The Coast district of New South Wales and East Coast of Queensland.

Acronychia lævis, Forst.

TIMBER.

DESCRIPTION AND USES.

This is practically a timber almost identical in qualities and colour to *Bosistoa sapindiformis*.

Systematic.

An average brush tree, botanically distinguished from *A. Baueri* in the flowers being glabrous, and disposed in axillary trichotomous cymes, narrow petals, thin and slightly coriaceous leaves, and four-angled fruits depressed on the summit.

Geographical Range.

The Coast district of New South Wales and Eastern Coast of Queensland.

Acronychia imperforata, F.v.M.

"FRASER ISLAND APPLE."

TIMBER.

DESCRIPTION AND USES.

The timber of this species is similar to those already described under the Genus, being very hard and of a bright-yellow colour.

Systematic.

An average brush tree similar to previous species, and distinguished from them by its more coriaceous leaves, ciliate filaments, and obovoid non-angular fruits not depressed at the top.

Geographical Range.

South Coast district of Queensland and North Coast of New South Wales.

Acronychia melicopoides, F.v.M.

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey states, Q. Fl., Vol. I, p. 210, that this timber is very hard, of a light colour.

Systematic.

A tall brush tree systematically differentiated from its congeners by the leaves being mostly three-foliate, with large obovate-lanceolate leaflets oblong, glabrous, lanceolate; petals under 4 lines long, and pear-shaped yellowish fruit, about 5 lines long.

Geographical Range.

It is found in the North Coast brushes of New South Wales and South Coast brushes of Queensland.

Halfordia drupifera, F.v.M.

TIMBER.

DESCRIPTION AND USES.

A smaller timber than its congener (*supra*), but otherwise of equal quality and merit as a very fine "Box" substitute timber.

H. = Very hard. W. = 63 lb. per cubic foot.

Systematic.

A smaller tree than the *Acronychias*, with a compressed yellowish bark, and differs from them in having simple leaves and ten stamens (five long and five short). Leaves glabrous, lanceolate, with a short petiole. Flowers numerous in a broad terminal panicle. Petals lanceolate, under 3 lines long, tomentose outside. Ovary glabrous, disk ten ribbed. Fruit a drupe, three-celled, about ½ inch long.

Geographical Range.

The North Coast district of New South Wales, the South Coast District and the Islands of Queensland.

Halfordia scleroxyla, F.v.M.

"KEROSENE TREE."

TIMBER.

DESCRIPTION AND USES.

A very fine timber, something of the nature of English Box, and like that wood close grained and yellowish in colour. Its great advantage over European Box is its freeness from knots and the much greater sizes of timber obtainable from it.

H. = Hard. W. = 60 lb. per cubic foot.

Systematic.

An average brush tree, with a greyish bark, differs botanically from its congener *H. drupifera* in having obovate-lanceolate coriaceous leaves with a glossy upper side, and a pretty red colour; globose-ovate fruit, with an acidulous pericarp, nearly an inch long.

Geographical Range.

The brushes of the East Coast of Queensland and North Coast of New South Wales.

NATURAL ORDER.

Simarubeæ.

THIS Natural Order may be regarded as typically tropical, although there are a few outliers, as in the case of the Australian species, and one at Nepaul.

The exotic species are famous more particularly for their medicinal properties rather than for their timber qualities.

The two species here mentioned are both classed as hardwoods, and, although not known commercially yet, are given as records of two little known timbers. One, *Cadellia monostylis*, is a beautiful timber and is worthy of forest cultivation.

SPECIES ILLUSTRATED IN COLOUR :—

Cadellia monostylis, Benth. (Black Plum).

Cadellia monostylis, Benth.

"BLACK PLUM." Plate. 9.

TIMBER.

DESCRIPTION AND USES.

This fine brush timber, having a beautiful figure, is hard, very close grained, canary-yellow in colour in the outer portion of the log, but darkening to a brown towards the centre, the two producing a beautiful figure. It somewhat resembles *Pithecolobium Hendersoni*, "Tortoise Shell Tulip," in figure and colour.

Suitable for panelling, cabinet work, veneers, marquetry, brush-backs, or any ornamental work, in addition to the common uses of a hardwood in the carriage construction and similar industries.

H = Hard. W. = 52 lb. per cubic foot.

Systematic.

A glabrous tree tree with a smooth pale bark, 60 to 100 feet high. Leaves with small deciduous stipules, alternate petiolate; from ovate lanceolate to elliptical oblong, shortly acuminate, mostly 3 to 4 inches long, narrowed at the base, membranous, or thinly coriaceous. Flowers in short axillary or terminal very short racemes. Pedicels about 2 inches long in the axils of minute bracts. Sepals nearly 2 lines long, shortly united at the base, membranous, persistent, and spreading after flowering. Petals rusty-tomentose, about twice as long as the sepals. Stamens ten, but in some of the flowers one or two are semi-abortive. Carpels in all the flowers seen solitary with the style silky and quite basal. Ovules as in *C. pentastylis*, collateral but horizontal or slightly ascending. Dupes shining, spherical, black or purple, about ½ inch long.

Geographical Range.

North Coast district of New South Wales, and South Coast Districts of Queensland.

PLATE 9.

BLACK PLUM

(*Cadellia monostylis*, BENTH.)

PLATE 10.

N.S.W. MAPLE.

(*Villaresia Moorei*, F.v.M.)

Cadellia pentastylis, F.v.M.

"REDWOOD."

TIMBER.

DESCRIPTION AND USES.

This wood has not much resemblance to its congener, *C. monostylis*, but more closely matches immature *Heterodendron oleæfolium*, Rosewood, of the interior. The wood is hard, dark red coloured, shorter grained and more interlocked than *C. monostylis*, the grain running both ways in narrow streaks of $\frac{1}{8}$ inch in width. Rather difficult to work. Should be suitable for carriage framing, coachwork, or for any purpose where a strong timber is required.

H. = Extremely hard. W. = 69 lb. per cubic foot.

Systematic.

A tree with a rough furrowed bark, about 40 feet, the smaller branches very slender and minutely pubescent. Leaves alternate, simple, from obovate-oblong to elliptical or lanceolate, obtuse, about $1\frac{1}{2}$ to 2 inches long, entire, narrowed into a short petiole, occasionally bearing a gland on one side, glabrous, penninerved and reticulate, not dotted. Flowers in short axillary racemes. Peduncles in the upper axils slender, bearing a short raceme of two to four flowers. Sepals nearly 3 lines long, at the time of flowering enlarged to 5 or 6 lines, and stellately spreading under the fruit. Petals white, slightly exceeding the sepals. Carpels five, the styles inserted above the middle. Fruit a drupe, small, about $1\frac{1}{2}$ line long, nearly globular.

Geographical Range.

New South Wales—Tenterfield-New England Plateau.

NATURAL ORDER.

Olacineæ.

UNFORTUNATELY, not many species of this Order are found in Australia, for it is from this family that the timbers of the common Ashes (*Fraxinus excelsior* and kindred species) of other countries are derived. It is a native of tropical and sub-tropical countries, and, usually, with the above exception, not remarkable for its timbers or other products, although in Australia several species yield good timber, such as *Pennantia Cunninghamii* and *Villaresia Moorei*. The latter species occurring in New South Wales is commonly known as "Maple," a not well-chosen term, as it has not the facies of any of the other timbers passing under that name. In figure it more nearly approaches the North American Sycamore, and, perhaps, some Oaks (*Quercus*), except for colour which is pale canary yellow.

SPECIES ILLUSTRATED IN COLOUR :—

Villaresia Moorei, F.v.M. (New South Wales Maple).

Villaresia Moorei, F.v.M.

"NEW SOUTH WALES MAPLE." Plate 10.

TIMBER.

DESCRIPTION AND USES.

Our local names are not always expressive of a distinctiveness of some well-known characters, and this is an instance. One generally associates Maple with Canada, and expects in this connection to find a timber that possesses some of the familiar features of that class of wood, but those are just what are not found in this case. It certainly is somewhat light in colour, but that is about all that obtains in this connection. The figure more nearly approaches that of English Beech, or small figured Oak, *Quercus*, and the same may be said of the texture, hardness, and colour. It could be used for all purposes to which English Beech is applied, and would make pretty panels or whole bedroom suites when *le tout ensemble* is white, or pale coloured. It could also be used for many other purposes where hardness and weight are the desiderata; it is comparatively easy to work, and takes a good polish. Care must be taken in seasoning or the timber will show a black stain.

H. = Hard. W. = 47 lb. per cubic foot.

FIG. XXIV.

CROSS SECTION, showing portions of three large rays; on the left very thick-walled fibres running parallel to the rays, irregularly otherwise; and angular pores are an unusual feature in timbers.

Micro. photo.

RADIAL SECTION, lower half occupied by portion of a large ray. The dark cells on the lower right contain calcium oxalate crystals

[*T. C. Roughley.*

TANGENTIAL SECTION, showing end views of large rays (crystal in middle of the bottom one); vessels with partition walls of cells on the left; chambered wood parenchyma to middle-right; fibres in dark masses.

VILLARESIA MOOREI, F.v.M.

"N.S.W. MAPLE."

ANATOMICAL FEATURES.

The features of this wood are quite specific in a transverse section, for the fibres appear to stand alone, being separated by compressed wood parenchyma, or a continuation of the walls of the latter or surrounded by them. The fibre walls are very thick, leaving a very small lumen, the wall perforations being very numerous and run in the long axis. The vessels are numerous and rather free from tyloses, but show some very fine examples of scalariform apertures. The rays are mostly free from the ordinary deposit, but a fair number of crystals were detected; the multiseriate kind of ray predominates, which is occasionally bounded by tracheid cells.

Systematic.

A tall handsome tree, with a pale, comparatively thin, yellowish, corrugated bark. Leaves ovate, lanceolate or oval, acuminate, varying in size up to 3 inches broad, and 6 inches long; petiole short, coriaceous and shining, pale on the underside. Flowers in lateral raceme-like panicles 2 to 4 inches long. Fruit a drupe, globular, ½ inch diameter, the putamen hard rugose outside.

Geographical Range.

The brushes of Southern Queensland and the Coast of New South Wales.

NATURAL ORDER.

Meliaceæ.

THIS Order is fairly well distributed in the tropical and sub-tropical regions of the world, and commercially might be called the Mahogany Order, as from it the famous mahoganies of commerce are derived, and in this connection one has only to mention Honduras Mahogany and Honduras Cedar, Indian Satin-wood and Red Cedar of Australia, to bring to mind some of its contributions to the cabinet timbers in general. Its principal Australian timbers, however, must not all be classed as cabinet woods, for there are one or two excellent hardwoods, the principal of which are—*Flindersia australis*, Teak; *F. Oxleyana*, Long Jack; *F. maculosa*, Leopard Wood; *F. Ifflaina*, Cairns Hickory.

SPECIES ILLUSTRATED IN COLOUR:—

Flindersia australis, R.Br. (Teak).
F. Oxleyana, F.v.M. (Long Jack).
F. Ifflaina, F.v.M. (Cairns' Hickory).

Amoora nitidula, Benth.

TIMBER.

DESCRIPTION AND USES.

A little known timber, but one deserving to be mentioned in this class of woods owing to its hard, tough, close-grained nature. Colour pale.

Systematic.

A tall brush tree with pinnate leaves having entire leaflets, numbering from two to four, opposite, no terminal one, elliptical oblong, 4 to 6 inches long, obtuse or shortly acuminate, sub-coriaceous, shining, the common petiole slightly dilated towards the end. Flowers very small in axillary panicles, loose but shorter than the leaves. Capsule obovoid or globular, hard woody opening loculicidually in three or four valves. Seeds nearly globular, apparently without any arillus.

Geographical Range.

The North Coast brushes of New South Wales and South Coast of Queensland.

*Flindersia australis, R.Br.

"TEAK." Plate 11.

TIMBER.

Description and Uses.

This is one of the finest hardwoods of Australia, of a dull yellow colour, and is in great request, more particularly for heavy carriage work and in naval dockyards. The grain is close with fine brown and white hair-like streaks; it is hard and of great strength and durability, one important character is that it does not rust iron; has a greasy nature, and rather difficult to dress. Suitable for flooring, decking, shipbuilding, cog-wheels, railway carriage framing, sheaves for blocks, and other hardwood purposes.

H. = Hard. W. = 54 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	6,320	8,000
Modulus of rupture in lb. per square inch	13,253	14,692
,, elasticity ,, ,, ...	2,549,610	3,169,565
Rate of load in lb. per minute	742	615

Anatomical Features.

An exceedingly close-textured wood, the very numerous fibres having thick walls, leaving only a small space for the lumen, the wall apertures being very few and very small, ovate and longitudinal. The pores are not numerous, the wood parenchyma running in lines between the solid mass of fibres, and also around them. Some long crystal parenchyma, with as many as thirty crystals, were seen.

The vessels have very numerous wall-pits, the partition walls of the cells belong to the scalariform variety; some contain a brown deposit.

The rays are fairly numerous, varying from uniseriate to three and four cells wide and several cells high.

Systematic.

One of the finest of brush trees, with a yellowish slightly rigid bark, with striate or spotted powdery branchlets. Leaves alternate, crowded at the end of short barren branches, glabrous; leaflets three to six, broadly lanceolate or oblong-elliptical, obtuse or scarcely acuminate, 2 to 4 inches long, scarcely oblique. Flowers numerous in terminal panicles much branched, terminating short branches without any leaves except a few scale-like bracts, sprinkled with a stellate tomentum. Calyx open, tomentose, with five short broad obtuse lobes. Petals about 2 lines long, tomentose outside except a narrow border, slightly pubescent inside. Fruit oblong, hard, tuberculate or muricate, opening septicidally in five boat-shaped valves without persistent axis.

Geographical Range.

New South Wales, North Coast Brush Forests to Northern Queensland Coast districts.

PLATE 11.

TEAK.

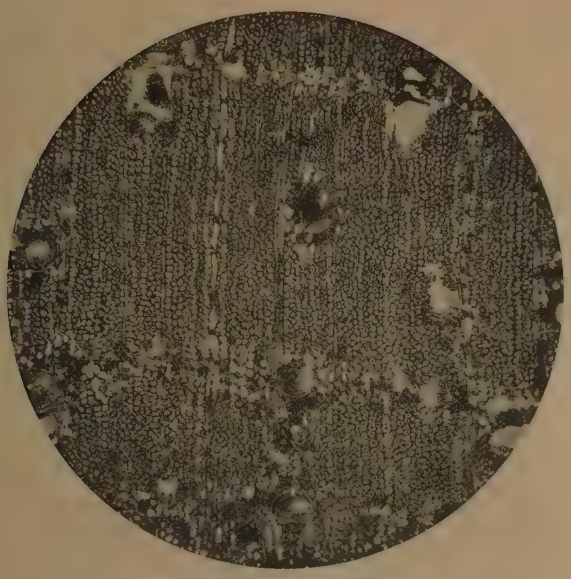
(*Flindersia australis* R.Br.)

PLATE 12.

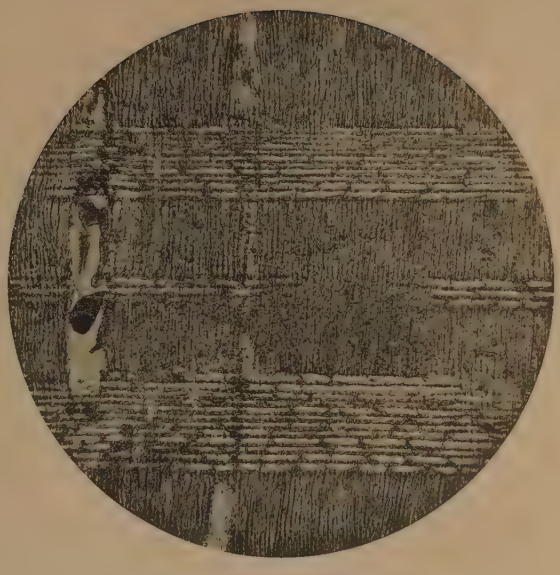
LONG JACK.

(*Flindersia Oxleyana*, F.v.M.)

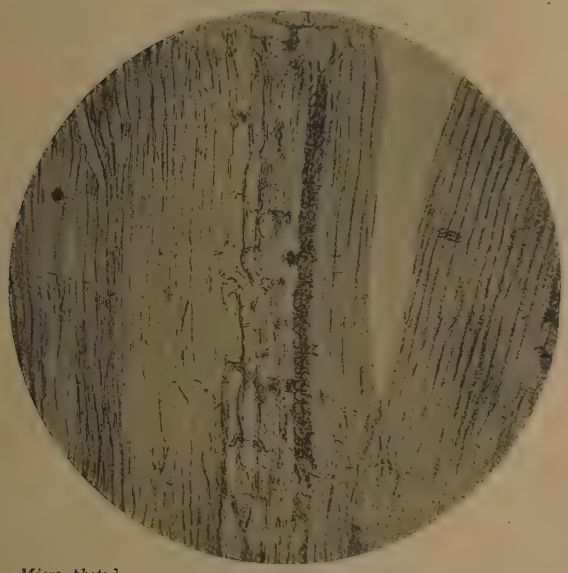
FIG. XXV.



CROSS SECTION showing compact bands of comparatively small fibres, alternating with bands of wood parenchyma; pores few, plugged with tyloses.

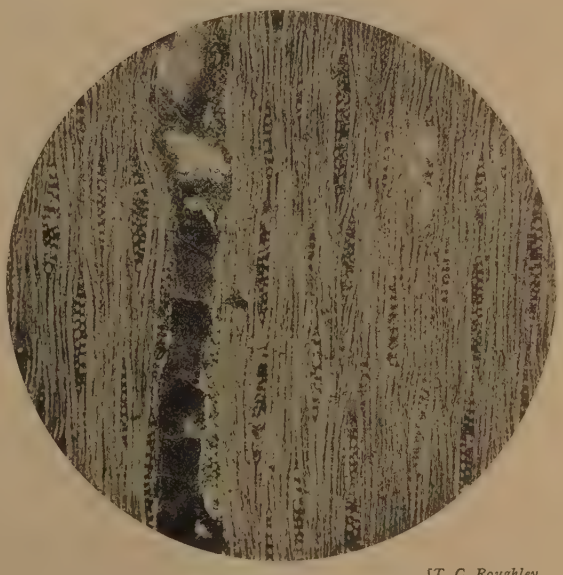


RADIAL SECTION, showing uniformity of wood elements. The dark verticle line in middle of top ray is a crystal parenchyma.



Micro. photo.]

RADIAL SECTION, showing two long conjugate wood parenchyma, with a crystal of calcium oxalate in each cell. In the centre is wood parenchyma; on both sides fibres. X100.



[*T. C. Roughley.*

TANGENTIAL SECTION, showing uniformity of wood texture and one vessel completely closed.

FLINDERSIA AUSTRALIS, R.BR.

"TEAK."

*Flindersia Oxleyana, F.v.M.

"LONG JACK." Plate 12.

TIMBER.

DESCRIPTION AND USES.

A light, yellowish-coloured timber, fairly hard, strong, durable, heavy and close-grained—especially seen in a transverse section. There is little sapwood, so that it cuts out to advantage. It is suitable for coachwork, panelling, picture-frames, joinery, cabinet work, and general carpentry, as well as for constructional works. Sometimes very tough to dress. Apparently a quick grower, and so is one that should hold a high place in any forestry scheme.

This timber is also known vernacularly as Mountain Ash and Yellow-wood, but these are only recorded here for identification of the wood and not to be perpetuated, as it is a distinct advantage for a timber to have only one commercial name, and that if possible a descriptive one of the wood, or at least one that shall give some index to its qualities. In this case the adjective evidently has been given by timber-getters in reference to the long straight stem, for the tree attains an average height of 120 feet, with an average diameter of 3 feet. The name Mountain Ash is retained for the Eucalypts going under that appellation, and Yellow-wood for *Rhodosphæra rhodanthema*, so that it is as well to keep now "Long Jack" for *F. Oxleyana*, if common names are to be perpetuated.

H. = Moderate. W. = 46 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	9,340	9,680	9,840
Modulus of rupture in lb. per square inch	18,130	19,100	19,680
„ elasticity „ „	.....	2,180,000	2,500,000
Rate of load in lb. per minute	549	1,760	1,500

Systematic.

A large forest tree of the Coastal brush lands, attaining a height of over 100 feet, with a thin, lightish-coloured, compact, fairly smooth bark. Leaves opposite, crowded under the flowering panicles; leaflets four to ten, with or without a terminal odd one, broadly lanceolate, oblique, inclining to falcate, narrowed into a distinct petiolule, sometimes with minute stellate hairs underneath. Flowers in a loose many-flowered panicle, shorter than the leaves. Sepals very small. Petals a little larger, glabrous, obovate oblong. Fruit an oblong hard capsule, muricate opening septicidally into five boat-shaped valves or cocci, without any persistent axis.

Geographical Range.

This tree is fairly plentiful in the brushes of the North Coast of New South Wales and the South Coast of Queensland.

*Flindersia Bennettiana, F.v.M.

"SHE TEAK."

TIMBER.

DESCRIPTION AND USES.

This is another very desirable timber in its class of Teaks or Long Jacks, and one that is worthy of afforesting, as it yields a fine hardwood, close in the grain and light in colour, with light brown figure, somewhat similar to American Ash. It is tough or leathery to work, but polishes well. Should be suitable for carriage and coachwork, shipbuilding, interior joinery, agricultural implements, and cabinet work.

H. = Hard. W. = 53 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	10,230	10,020
Modulus of rupture in lb. per square inch ...	21,300	20,863
,, elasticity ,, ,, ...	2,450,000	2,920,600
Rate of load in lb. per minute	1,023	1,002

Systematic.

A large tree with a clean somewhat reddish yellow bark, sometimes tesselated at the base. Branchlets angular. Leaves opposite, the petioles somewhat flattened with thin, sharp edges, crowded under the panicles, leaflets three to five, from ovate to ovate-lanceolate or oblong elliptical, obtuse or scarcely acuminate, 2 to 3 inches long in some specimens, 4 to 5 inches and 2¼ inches broad in others, glabrous, very coriaceous, not oblique and scarcely petiolulate, the common petiole angular. Flowers in panicles varying in size. Fruit 2 or 3 inches long, muricate. Seeds two in each cell, broadly winged at the upper end only, or some with a very small wing at the lower end.

Geographical Range.

Northern Coast districts of New South Wales and East Coast districts of Queensland.

Flindersia maculosa, Lindl.

"LEOPARD TREE."

TIMBER.

DESCRIPTION AND USES.

This is one of the closest grained timbers of Australia, resembling English Box in almost every character. It is bright yellow in colour, nicely marked, of a very hard and tough nature, and difficult to dress, but polishes well. Suitable for bearings of shafting and other purposes

for which exotic Boxes are employed ; sapwood very narrow. Owing to its qualities this timber should be preferred to the Box (*Buxus*), on account of the much larger sizes that can be obtained, thus giving it a decided advantage over the exotic.

H. = Very hard. W. = 54 lb. per cubic foot.

Systematic.

A medium-sized tree, bark with dark and pale markings, falling off in scale-like pieces, giving a spotted appearance to the stem, hence called Leopard Wood or Spotted Tree. Leaves simple, opposite, linear oblong, 1½ to 2 inches long, 6 or 7 lines broad, obtuse at the apex. Flowers small in a terminal pyramidal panicle, seldom much exceeding 1½ inch on short peduncles. Flowers globose in the bud, very shortly pedicellate. Calyx of five rotundate-ovate ciliate sepals. Petals five, glabrous, about 2 lines long, imbricate, obovate, membranous. Stamens glabrous. Ovary hairy, globose, five-celled. Stigma almost or quite sessile, discoid, five angular. Fruit elliptical, oblong, 1 inch or more long, densely muricate. Seeds winged at both ends.

Geographical Range.

Plains of the Interior of New South Wales. Queensland, Scrubs on the Burdekin and Burnet Rivers, Port Bowen, and Broad Sound.

*Flindersia Ifflaina, F.v.M.

"CAIRNS' HICKORY." Plate 13.

TIMBER.

DESCRIPTION AND USES.

A timber with somewhat the facies of "Teak," *Flindersia australis*, and having a similar greasy nature. It is of a yellowish colour, very close grained on the end section, but yet the vessels being large give it an open appearance when cut and planed longitudinally. It has often a fine, big, wavy figure, and is useful for heavy beams and constructional works, parts of ship-building, piles, wharfs, machine bearings, cogs, and other purposes requiring a strong, close-grained timber. It would make a good substitute for Greenheart.

H. = Very hard. W. = 57 lb. per cubic foot.

Systematic.

A tall evergreen tree, the branchlets, petioles, and peduncles slightly puberulent. Leaves opposite on long petioles, leaflets thick-chartaceous, almost ovate, glabrous on both sides, six to ten, pari-pinnate, 2½ to 4½ inches long, rhachis angular. Flowers very numerous in panicles terminal, peduncle somewhat short. Calyx not 1 line long. Petals equally small, ovate, glabrous inside, outside thinly pilose. Style very short, stigma, peltate. Fruit a capsule about 2 inches long, tuberculate with large and small rough tubercles, valves separating. Seed 4 or 5 lines, winged at the upper end only.

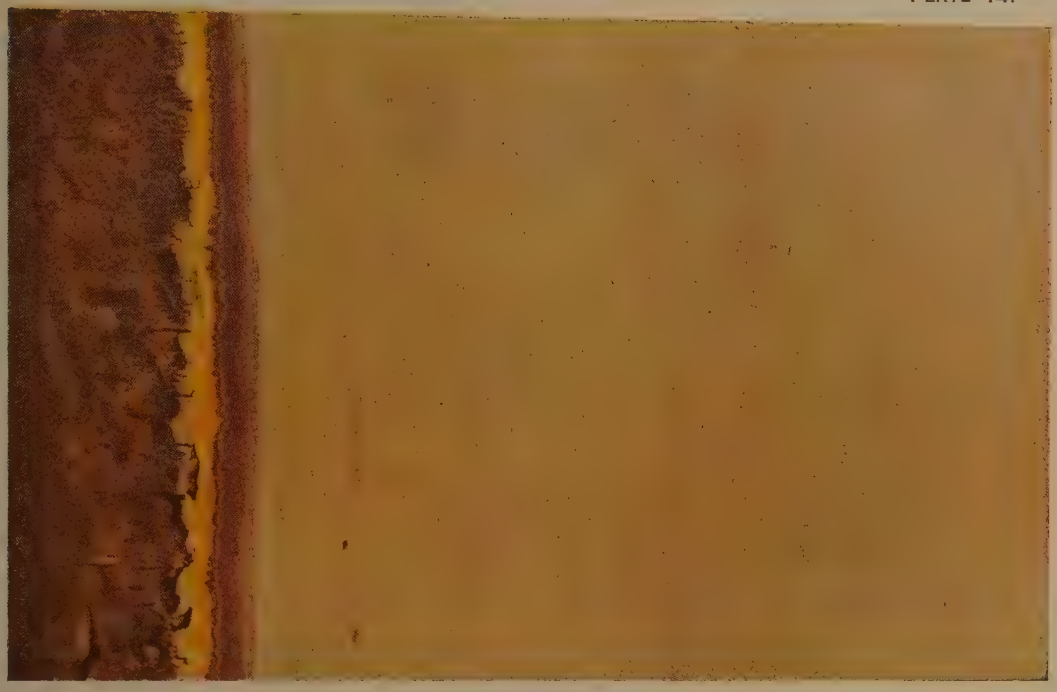
Geographical Range.

North Coast of Queensland.

PLATE 13.

CAIRNS HICKORY.
(*Flindersia Ifflaiana*, F.v.M.)

PLATE 14.



YELLOW BARK.
(*Celastrus dispermus*, F.v.M.)

NATURAL ORDER.

Celastrineæ.

In Europe this Order is known as the Spindle-tree Order, and is one that has a fairly world-wide range, being a native of countries of the northern hemisphere, and is also plentiful in South Africa, being more abundant in the tropics than in temperate regions.

The representatives in Australia are either shrubs or trees, and occur in the Northern Territory, Queensland, and New South Wales. Their timber is little known, but nevertheless, it is an acquisition to Australia's already long list of hardwoods. They are fine, even-grained timbers, very pale, almost white, and quite equal in texture and strength to English Box. They are worthy of consideration in any scheme of afforestation of indigenous trees.

Species Illustrated in Colour :—

Celastrus disperma, F.v.M. (Yellow Bark).

Celastrus dispermus, F.v.M.

"YELLOW BARK." Plate 14.

TIMBER.

Description and Uses.

This is one of the finest of our light-coloured yellow hardwoods, being tough and strong, and a suitable substitute for English Box. It takes a good polish, and could be used in a number of different trades with good effect. It is a little known timber.

H. = Moderate. W. = 47 lb. per cubic foot.

Systematic.

A small glabrous tree. Leaves elliptical, obvate-oblong, or rarely broadly lanceolate, obtuse or slightly acuminate, 2 to 3 inches long, quite entire, much narrowed into a rather long petiole. Flowers in racemes, axillary or lateral. Capsule obovoid or obcordate, slightly compressed, 3 to 4 lines long, two-celled and two-valved, with usually two seeds, covered at the base, according to F. Mueller, with a thick arillus; very rarely the capsule is three-angled and three-celled.

Geographical Range.

Coast districts of New South Wales and Queensland.

Denhamia obscura, Meissn.

TIMBER.

DESCRIPTION AND USES.

A species with a fairly large distribution in the Northern States, and, according to F. M. Bailey, Q. Fl., Vol. I, p. 254, has a wood of a light yellow colour, very close in the grain, and easily worked; useful for engraving and cabinet work.

Systematic.

A tall shrub or small tree, the young branches generally pendulous. Leaves mostly oblong-lanceolate, acuminate, 2 to 3 inches long, entire, with often wavy margins, narrowed into rather a long petiole, coriaceous, finely but not prominently veined; on barren branches the leaves are sometimes broadly ovate and bordered by prickly teeth like those of a Holly. Flowers in small pendunculate cymes in the upper axils, or forming a short oblong terminal panicle. Ovales four to eight to each capsule, ovoid or globular, attaining about 1 inch, of a pale-whitish hue when dry, the thick valves bearing slightly projecting placentas along their centre.

Geographical Range.

The northern parts of Queensland and North Australia.

Denhamia pittosporoides, F.v.M.

TIMBER.

DESCRIPTION AND USES.

A brush timber of the Coast districts of Queensland, with a wood of a uniform pale colour, resembling English Elder; suitable for engraving, pattern-making, and similar uses (Bailey). It is very close in the grain, tough, has little sapwood, polishes well, and could also be used for inlaying.

H. = Moderate. W. = 43 lb. per cubic foot.

Systematic.

A tree, the trunk, according to Thozet, beautifully striated. Leaves lanceolate or rarely ovate-lanceolate, obtuse, 2 to 3 or rarely 4 inches long, obtusely serrate, narrowed into a petiole, coriaceous, with very prominent pinnate and reticulate veins, not so glaucos as in the other two species. Flowers in cymes pedunculate, or at the base of young leafy branches. Capsule globular, attaining in our specimens ½ inch or rather more, but many of them opening when at half that size, the thick woody valves bearing the dissepiments on their centre.

Geographical Range.

The East Coast and Northern parts of Queensland.

Siphonodon australe, Benth.

"NATIVE GUAVA" OR "IVORY WOOD."

TIMBER.

DESCRIPTION AND USES.

This is a beautiful white timber, and worthy of cultivation in our forest lands. It is a very close-grained wood and has no sapwood, and would make a good substitute for English Box, the utilities of which are too well known to be repeated here.

H. = Hard. W. = 48 lb. per cubic foot.

Systematic.

A tree of 40 feet or more in height. Leaves obovate or broadly oblong, obtuse, 2 to 3 inches long, entire or slightly sinuate coriaceous, drying the pale colour so frequent in *Celastrineæ*. Flowers on a short peduncle, white, very small, 2¼ lines long. Drupe globular, ¾ to 1 inch diameter, the flesh hard and dry, with the stigmatic scar at the top, and the scar of the calyx at the base, as in *S. celastrineus*. Nuts numerous, appearing to have been arranged in two rows in each of five cells, irregularly ovoid, somewhat compressed, 3 to 4 lines long. Testa of the seed brown; albumen not very thick; cotyledons broadly ovate.

Geographical Range.

The North Coast district of New South Wales, and the South-east Coast districts of Queensland.

NATURAL ORDER.

Rhamneæ.

THIS Order is fairly well distributed over the world, and Australia has one or two good representatives of its timbers. *Alphitonia excelsa* is a particularly fine, red-coloured wood, the texture, weight, and colour being suitable for several kinds of timber work. It is often found on the market, and passes into ordinary use, but merchants not being able to botanically identify it, sell it under several names.

SPECIES ILLUSTRATED IN COLOUR :—

Ventilago viminalis, Hk. (**Supple Jack**).
Alphitonia excelsa, Reiss. (**Red Ash**).

Ventilago viminalis, Hook.f.

"SUPPLE JACK." Plate 15.

TIMBER.

DESCRIPTION AND USES.

This is a timber that is little known outside its geographical area. It is hard, heavy, dark-coloured, and so would only be useful for special work; much resembles in some respects the dark-hearted Acacia timbers, and amongst its features may be mentioned its difficulty to dress. It is suitable for any kind of ornamental turnery, brush backs, fancy boxes, and also for purposes requiring hardness and weight in timber.

H. = Extremely hard. W. = 78 lb. per cubic foot.

Systematic.

A small glabrous tree occurring in the interior of New South Wales and Queensland and Northern Territory. Leaves alternate, narrow lanceolate to lanceolate up to 5 inches long, entire, lateral veins very oblique and sometimes parallel with the edge, rather thin. Flowers small, clustered in the branches of axillary or terminal panicles. Fruit globular at the base, produced into an oblong or linear coriaceous wing, one cell, one seed, about 1 inch long.

Geographical Range.

Interior of New South Wales and Queensland.

PLATE 15.

SUPPLE JACK.
(*Ventilago viminalis*, HOOK.)

PLATE 16.

RED ASH.
(*Alphitonia excelsa*, REISS.)

*Alphitonia excelsa, Reiss.

"RED ASH." Plate 16.

TIMBER.

Description and Uses.

This is one of the widest distributed trees on the Eastern coast of the Continent, although the timber is not often recognised on the market, but it is nevertheless one of our finest timbers, being close grained, hard, fairly heavy, but with practically no figure, its strong recommendation being its high red colour. When first planed only a tinge of red is seen, but on exposure the colour deepens to a bright cardinal. It could be used for coach and railway carriage building, waggons, heavy doors, decorative carving and turning. It is an excellent, red, hardwood. The outer secondary wood is pale coloured and well defined from the inner portion.

H. = Hard. W. = 46 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	7,990	7,460
Modulus of rupture in lb. per square inch...	15,510	15,050
„ elasticity „ „ ...	1,864,000	1,610,000
Rate of load in lb. per minute	380	1,200

Anatomical Features.

A uniformly constructed timber, the fibres having walls of medium thickness, and are arranged in regular medullary rows; the wall perforations are very few. The vessels have rather a small diameter, stout walls, and the cells formed by the partition walls are also small. Tyloses were not seen. The wood parenchyma is very scarce, but the rays are numerous, although small and from one to two cells wide and a few high, the cells of the central ones are elongated and narrow, the outer ones short, with the long axis vertical.

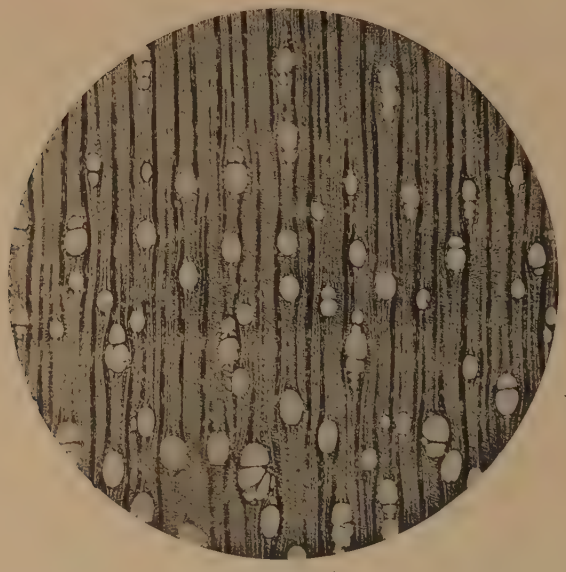
Systematic.

A tall tree, found near water or ridges overlooking water, open country or brush forests, the young branches have a rusty tomentum. Bark hard, compact, often with a whitish coating. Leaves characteristic, alternate, ovate to lanceolate, large, entire, subcoriaceous; glabrous above, white or hoary underneath with a close tomemtum, veins prominent. Flowers in small umbel-like cymes, arranged in dichotomous cymes in the upper axils or in a terminal corymbose panicle. Fruit globular or broadly ovoid, separating into two or three hard carpels. Seeds shining, enclosed in a reddish-brown arillus.

Geographical Range.

Curtis Island, Queensland, to Mount Dromedary, to near the Southern border of New South Wales.

FIG XXVI.



CROSS SECTION, showing uniformity of wood elements; darker part across the centre marks the late growth; a deposit in the cells gives the rays the dark appearance.

Micro. photo.]

RADIAL SECTION, showing at lower half a number of uniform rays, with a brown deposit in some cells, and compact masses of fibres in upper half; five vessels are cut at varying angles.

[*T. C. Roughley.*

TANGENTIAL SECTION, showing deposit in rays and four vessels; wall structure best seen in the left one.

ALPHITONIA EXCELSA, REISS.

"RED ASH."

Emmenospermum alphitonioides, F.v.M.

"BONE WOOD."

TIMBER.

Description and Uses.

A not uncommon timber of the Coast districts of New South Wales and Queensland, and one that yields a desirable hardwood which is of a light greyish colour, close in the grain, free working, of a greasy nature, and somewhat resembles the Greenheart of Guiana.

H. = Very hard. W. = 53 lb. per cubic foot.

Anatomical Features.

This is not so uniformly structured as its congener *Alphitonia excelsa*. The fibres are arranged in regular radial rows, but of varying diameters, with thick walls, and compressed next to the rays, having a small lumen, the wall perforations being few. The vessels are fairly numerous, but often two or three conjugate, the walls being strong and full of perforations, but free from tyloses. The wood parenchyma is exceptionally sparse around the pores, whilst the heterogeneous rays are numerous—composed of (1) all large cells or (2) small and large. No amorphous deposits of any kind were detected in the wood elements, but a few crystals were found in the rays.

TRANSVERSE TEST OF TIMBER.

(The following was made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

Breaking load in lb.	10,500
Modulus of rupture in lb. per square inch...	21,867
,, elasticity ,, ,, ...	2,449,500
Rate of load in lb. per minute	1,050

Systematic.

A tall timber tree, quite glabrous. Leaves opposite, or nearly so, petiolate, ovate, acuminate, 2 to 3 inches long, entire, coriaceous, shining above, green on both sides. Flowers numerous, in little dense umbel-like cymes, arranged in trichotomous cymes or corymbose panicles in the upper axils or terminal. Fruits apparently about 3 lines long, but either unripe or already open in our specimen. Seeds persistent, like those of *Alphitonia*, but without the peculiar arillus of that species.

Geographical Range.

The Coast districts of Queensland and New South Wales.

FIG. XXVII.

CROSS SECTION, showing rays cut through the outer and inner rows of ray cells (larger and smaller respectively), small fibres in radial rows, and regular distribution of pores.

Micro. photo.]

RADIAL SECTION, showing heterogeneous rays and fibres (the dark spots mark the break where they interlock); lower left, are seen two vessels with wood parenchyma between them.

[*T. .C Roughley.*

TANGENTIAL SECTION, showing numerous vessels with ecll partitions, and ordinary bordered pits. 'and one tc five seriate rays.

EMMENOSPERMUM ALPHITONIOIDES, F.V.M.

"BONE WOOD."

NATURAL ORDER.

Sapindaceæ.

As a timber yielder outside Australia this Order does not seem to rank very high. In this continent, however, the timbers are fairly numerous and of high quality, being hard, close grained, tough and strong, and with a few exceptions, lacking in figure, except as occurs in the case of *Harpullia pendula*, Tulip Wood; *Ratonia tenax*, Brush Teak; and *Nephelium semiglauca*, Wild Quince, which, although suitable timbers for many purposes, yet are rarely found on the market. Every effort should be made to re-afforest these excellent hardwoods before they are all finally destroyed, for they must rank as some of the finest in Australia.

SPECIES ILLUSTRATED IN COLOUR :—

Ratonia tenax, Benth.
Harpullia pendula, Planch. (Tulip Wood).
Cupania nervosa, F.v.M. (Beetroot).
Nephelium foveolatum, F.v.M.
Diploglottis Cunninghamii, Hk. (Tamarind).

Ratonia pyriformis, Benth.

"BRUSH APPLE."

TIMBER.

DESCRIPTION AND USES.

This species yields a splendid, very light brown, pleasing, coloured timber, which darkens slightly towards the centre, where it shows a faintly darker, brown, ribbed streak. It is close grained, with a wavy figure, fairly hard, but free to work, and polishes well.

It is eminently suited for carriage work, either structurally or decoratively. Like most of the genus, it should be re-afforested on a large scale.

H. = Moderate. W. = 44 lb. per cubic foot.

Systematic.

A tree of considerable size, but flowering somewhat as a shrub, glabrous except a minute hoariness on the young shoots and panicles. Leaflets three to six, ovate or ovate-lanceolate, shortly acuminate, ¾ to 6 inches long, entire, very coriaceous, on petioles of ½ inch or more. Flowers very small, shortly pedicellate, singly or in little cymes of two or three along the raceme-like branches of the panicle. Capsule globular, pear-shaped, about 4 lines diameter, narrowed into long stipes, glabrous, with three raised ribs, appearing almost drupaceous and scarcely dehiscent. Seeds often reduced to two or one, enclosed in the arillus; cotyledons much folded. Radicle somewhat broad and much compressed.

Geographical Range.

Brisbane River, Moreton Bay, and Southern Queensland, and brushes of North Coast of New South Wales.

Ratonia anodonta, Benth.

TIMBER.

DESCRIPTION AND USES.

A fine timber, light brown in colour, inclined to slightly darken towards the centre, close, but rather short in the grain; hard and tough. It should be suitable for machinery blocks, or for any purpose where timber is subjected to a certain amount of hard wear.

H. = Very hard. W. = 60 lb. per cubic foot.

Systematic.

A tree of considerable size, flowering also as a shrub, quite glabrous. Leaflets two, three, or rarely four, ovate or ovate-lanceolate, obtuse or obtusely acuminate, 2 to 4 inches long, coriaceous but not thick, very much reticulate, narrowed into a petiolule of $\frac{1}{2}$ to nearly $\frac{1}{4}$ inch. Panicle glabrous, slender, not much branched. Calyx glabrous, about $\frac{3}{4}$ line diameter. Seeds often reduced to two or one, enclosed in the arillus. Embryo much curved; cotyledons folded, but less so than in *R. pyriformis*.

Geographical Range.

Coast districts of Queensland.

Ratonia stipitata, Benth.

TIMBER.

DESCRIPTION AND USES.

A fine, very hard wood, of a light brown colour, with almost black duramen, much resembling in the latter portion Black Bean, *Castanospermum australe*, or the Italian Walnut. It is close grained and interlocked, and should be suitable for tool handles, veneers, ornamental cabinets, heavy furniture, carriage work, or any purposes requiring a strong timber.

H. = Very hard. W. = 58 lb. per cubic foot.

Systematic.

A moderate-sized tree, glabrous except a minute tomentum on the young branches and inflorescence. Leaflets three to six, oblong-lanceolate, acute, 2 to 3 inches long, narrowed into a petiolule of 3 or 4 lines, coriaceous, very rigid, shining above, the primary veins very prominent underneath. Panicles axillary and terminal, divaricately branched. Flowers very small in oblong panicles. Capsules three-angled, depressed at the top, $\frac{1}{2}$ inch broad, narrowed into a short but distinct stipes, valves thickly coriaceous, almost woody, glabrous and reddish inside. Seeds shining, in a thin arillus.

Geographical Range.

New South Wales, Macleay and Clarence River districts. Queensland, near border of New South Wales.

Ratonia tenax. Benth.

"BRUSH TEAK." Plate 17.

TIMBER.

Description and Uses.

This is another splendid wood of the genus and worthy of extensive re-afforestation. It is an average hardwood, very tough and close grained, light brownish in colour, but darkens slightly towards the centre, and often has an oblique, wavy, interlocked grain, which makes it very decorative for cabinet work; this figure makes it eminently suitable for fiddle backs. Sapwood very limited. It polishes well, and should be suitable for coach work generally, but could probably be used for many other purposes not yet investigated in the technology of our timbers.

H. = Hard. W. = 46 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	4,910	3,990
Modulus of rupture in lb. per square inch...	10,120	8,224
„ elasticity „ „ ...	1,972,400	1,335,100
Rate of load in lb. per minute	818	798

Anatomical Features.

This wood is of a uniform texture, the fibres being of equal diameter, with walls of medium thickness, thus leaving a fair sized lumen; the numerous wall perforations running with the long axis of the fibre. The vessels are rather small, but fairly numerous and scattered irregularly throughout the other wood elements, and with an absence of tyloses. The wood parenchyma is more limited than that of most timbers examined and the few seen had their cells filled with crystals. The ray parenchyma had in almost every instance a deposit in the narrow horizontal cells; vertical cells border these top and bottom. They were, almost and without exception, of the uniseriate form and a few cells high.

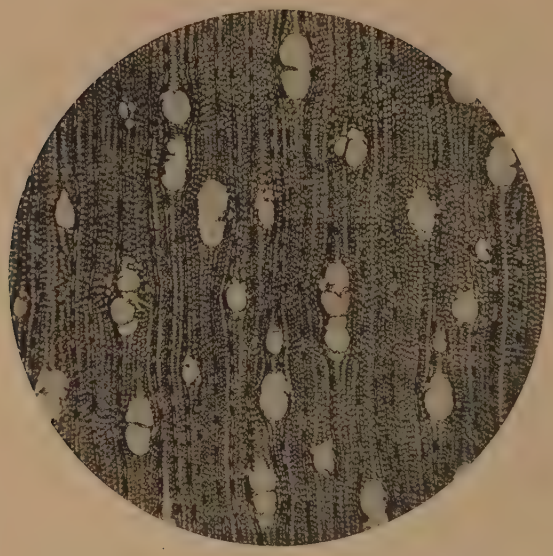
Systematic.

An average brush tree, quite glabrous, except the inflorescence. Leaflets usually three, but varying from two to eight, from obovate to oblong-elliptical or lanceolate, obtuse, 1½ to 2, or rarely 5 inches long, much narrowed at the base, but scarcely petiolulate, thinly coriaceous, shining above, pale or sometimes slightly glaucous underneath, with foveoles in the axils of the nerves. Flowers small, in equally small panicles, little branched. Capsule usually flattened, two-celled, about ½ inch broad, contracted into a very short stipes. Valves thick, densely villous inside. Seeds apparently only half developed in the arillus.

Geographical Range.

Brushes of the Coast district of Queensland and New South Wales.

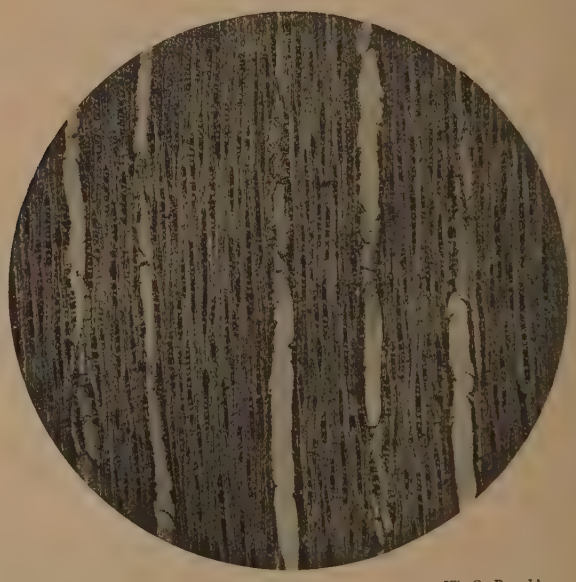
FIG. XXVIII.



CROSS SECTION, showing uniformity of wood elements.

Micro. photo.]

RADIAL SECTION showing rays with deposit in some of the cells; five vessels cut at various angles owing to wavy grain of wood. Crystal parenchyma shown in upper half of the section.



[*T. C. Roughley.*

TANGENTIAL SECTION, showing uniseriate character of rays with the dark cell deposit; vessels cut at varying angles are also a feature.

RATONIA TENAX, BENTH.

"BRUSH TEAK."

PLATE 17.

BRUSH TEAK.
(*Ratonia tenax*, BENTH.)

PLATE 18.

TULIP WOOD.
(*Harpullia pendula*, BLANCH.)

*Harpullia pendula, Planch.

"TULIP WOOD." Plate 18.

TIMBER.

Description and Uses.

This is not a common tree in the northern brushes where it has made its home, but specimens of the timber occasionally find their way to the market. The wood is close grained, hard and heavy, yet works easily, and has a pretty figure produced by a dark brown or almost black colouring with whitish streaks. It is very suitable for turnery, and has been used for small mallets and handles of medical and other scientific instruments. Apart from its cabinet qualities, the tree itself makes a very ornamental park addition, and is well worthy of cultivation. The wood looks well in ornamental boxes, picture frames, salvers, &c., decorated with silver, when a contrast is produced between the white metal and the darker wood.

A list of the cabinet timbers would not be complete, perhaps, without a few remarks on this particular wood, and if the tree were only more numerous, the timber would be much in request. That it was a regular article of commerce in the past is proved by the following quotation taken from a toy and fancy article advertisement in a Sydney Directory of 1848 :—

> ". . . . also Ebony, Australian Tulip Wood, ... Henry Parkes (afterwards Sir Henry Parkes, Premier of New South Wales), Ivory and Bone Toy Manufacturer, No. 20 Hunter-street."

H. = Very hard. W. = 58 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	8,520	7,920	9,330
Modulus of rupture in lb. per square inch...	18,425	16,459	20,035
„ elasticity „ „ ...	2,705,000	2,358,300	2,239,600
Rate of load in lb. per minute	946	990	933

Systematic.

A tall tree of the northern brush. Leaves pinnate, leaflets usually three to six, ovate to elliptical-oblong, obtusely acuminate, 3 to 5 inches long, thin or membranous, veins prominent underneath. Flowers in loose, slender, terminal, little-branched panicles, small. Sepals under ¼ inch long. Petals ovate, slightly larger. Stamens five to seven, much longer than the calyx, with slender filaments in the males, small and short in the females. Fruit a glabrous capsule, 1 to 1½ inch broad, the lobes inflated. Seeds without any arillus.

Geographical Range.

In the brushes of the North Coast district of New South Wales and Queensland.

Cupania anacardioides, A.Rich.

"TUCKEROO."

TIMBER.

DESCRIPTION AND USES.

This timber is slightly softer than most of the Cupania species, and has the appearance of being a short-grained timber, but is free-working, although close-grained and tough. It is suitable for heavier kinds of cabinet making, tool handles, and carriage framing, and general purposes requiring strength.

H. = Hard. W. = 52 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	9,460	8,250
Modulus of rupture in lb. per square inch...	19,693	17,174
,, elasticity ,, ,, ...	2,618,534	2,169,642
Rate of load in lb. per minute	946	916

Systematic.

A slender tree, quite glabrous or with a minute hoariness on the inflorescence. Leaflets six to ten, usually eight, from broadly ovate or obovate to elliptical-oblong, very obtuse, 2½ to 4 inches long, rounded at the base and shortly petiolulate, quite entire, coriaceous. Flowers rather large for the genus, in pedunculate cymes along the branches of loose panicles. Capsule glabrous, coriaceous, acutely and divaricately three-lobed, 6 to 8 lines broad, very shortly attenuate at the base.

Geographical Range.

A Coastal timber of Queensland and New South Wales.

Cupania tomentella, F.v.M.

TIMBER.

DESCRIPTION AND USES.

This is another of the finest timbers to be found in this Natural Order. It is pale in colour, hard, medium open grain, with practically no figure, but nevertheless has a pleasing facies and, like its congeners, is of first-class quality. It should be suitable for coach and carriage work, tool handles, cabinet work, and many other technical purposes.

H. = Hard. W. = 50 lb. per cubic foot.

Systematic.

Possibly a variety of *C. serrata*, of which it has the inflorescence. Flowers in panicles not much branched. Bracts rather large, tomentose, deciduous, nearly sessile. Sepals orbicular, and petals small with a short scale as in *C. serrata*. Anthers oblong, slightly pubescent. Capsule three-angled, thickly coriaceous, velvety-tomentose, and rugose, ¾ inch broad.

Geographical Range.

North Coast district of New South Wales and East Coast of Queensland.

Cupania pseudorrhus, A.Rich.

"FERN TREE."

TIMBER.

DESCRIPTION AND USES.

In figure and colour this very much resembles New Zealand Rimu, but of course is very much harder. It is very pale brown in colour, darkening towards the centre, close in the grain, and very tough. It is a good all-round timber and a useful general hardwood, also suitable for small cabinet work, tool handles, &c.

H. = Moderate. W. = 46 lb. per cubic foot.

Systematic.

A spreading tree of moderate size, the young branches and petioles densely rusty-tomentose. Leaves crowded under the panicles. Leaflets thirteen to twenty-one, or even more, lanceolate or ovate-lanceolate, acuminate, 1½ to 3 inches long or rarely more, very oblique or almost falcate, nearly glabrous and shining above when full grown, more or less tomentose or pubescent underneath. Flowers rather small on short pedicels. Panicles usually much branched and rather dense, rarely exceeding the leaves, tomentose. Capsule globular, slightly lobed, almost woody, densely hirsute with short velvety hairs, about ½ inch diameter. Arillus small.

Geographical Range.

A brush timber of the Coast of New South Wales and Queensland.

Cupania nervosa, F.v.M.

"BEETROOT." Plate 19.

TIMBER.

DESCRIPTION AND USES.

This timber is white, close grained, tough, with a wavy figure, and difficult to work. It has little sapwood, and would make a good substitute for American Hickory.

H. = Moderate. W. = 50 lb. per cubic foot.

Systematic.

A moderate-sized tree, the young branches and inflorescence minutely hoary tomentose, otherwise glabrous. Leaflets three to six, rarely more or reduced to two, lanceolate or rarely elliptical-oblong, mostly 3 to 6 inches long, sinuate-toothed or entire, glabrous, with very rarely small tufts underneath in the axils of the raised primary veins. Racemes usually simple, axillary, 1 to 2 inches long; the flowers all pedicellate and larger than in *C. xylocarpa*. Capsule nearly globular, three-angled, about ½ inch broad, woody, glabrous or nearly so outside, the valves villous inside.

Geographical Range.

A brush species of the Coasts of Queensland and New South Wales.

Nephelium semiglaucum, F.v.M.

"WILD QUINCE."

TIMBER.

DESCRIPTION AND USES.

Although this species yields a splendid hardwood, yet it is not often used. It is close grained with a small wavy figure, and light brown in colour; rather difficult to work, and could be used for coach, carriage, light coloured furniture, and many other commercial purposes.

H. = Very hard. W. = 62 lb. per cubic foot.

Systematic.

A middle-sized tree. Leaflets two to four, or rarely six, oblong-elliptical, or from almost obovate to nearly lanceolate, obtuse or rarely almost acute or mucronate, 2 to 3 or rarely nearly 4 inches long, entire, narrowed into a short petiolule, coriaceous, glabrous and somewhat shiny above, more or less glaucous underneath. Panicles either small and axillary or terminal and much branched, but shorter than the leaves, glabrous or minutely pubescent. Capsule four to five lines diameter, glabrous, very shortly attenuate at the base, with divaricate compressed lobes. Seeds smooth and shiny, with a thin arillus.

Geographical Range.

A rather common littoral of the East Coast of Queensland and New South Wales.

Nephelium tomentosum, Benth.

TIMBER.

DESCRIPTION AND USES.

A splendid representative timber of the Order, being close grained and hard, of a light brown colour, but has no figure. It is suitable for carriage framing, coachwork, wheelwrights, small cabinet work, tool handles, &c., and should be a good commercial hardwood.

H. = Very hard. W. = 64 lb. per cubic foot.

Systematic.

A tree of 20 to 30 feet in height. The young branches and petioles clothed with a soft rust-coloured, velvety tomentum. Leaflets four to eight, from oval-oblong to oblong-lanceolate, acute, or rarely obtuse, 2 to 4 inches long, acutely toothed, or rarely almost entire, thinly coriaceous, pubescent above or at length glabrous, tomentose, pubescent underneath. Flowers small, crowded on short, slightly-branched tomentose panicles, sometimes reduced to simple racemes. Pedicels very short. Calyx nearly one line long, the lobes rather deep and acute. Petals none. Fruit softly tomentose-villous, depressed at the top, of two or rarely three globular slightly-compressed lobes, united to the top, 4 or 5 lines diameter, rather hard, indehiscent. Seeds half immersed in a yellowish arillus.

Geographical Range.

The Northern and East Coasts of Queensland, and the Coast of New South Wales.

PLATE 19.

BEETROOT.

(*Cupania nervosa*, F.v.M.)

PLATE 20.

(*Nephelium foveolatum*, F.v.M.)

Nephelium foveolatum, Benth.

Plate 20.

TIMBER.

Description and Uses.

This is a splendid brush species and typical of the Genus. The timber is hard, close grained, and of a pale brown colour, but has no figure. It is very suitable for tool handles, heavy coach and waggon work, or for such trade purposes requiring a hard, strong material.

H. = Hard. W. = 54 lb. per cubic foot.

Systematic.

A tree of considerable size, the young branches and inflorescence rusty-tomentose. Leaflets four to six, ovate lanceolate or almost ovate, obtuse or acuminate, 3 to 5 inches long, entire or sinuate toothed, narrowed into a distinct petiolule of 1 to 3 lines, thinly coriaceous, glabrous or rarely slightly pubescent underneath, having frequently a cup-shaped cavity in the axils of the primary veins. Flowers in broad and many-flowered panicles in the upper axils, but shorter than the leaves, in little clusters or cymes along the principal branches. Fruit tomentose, deeply divided into two, three, or sometimes four lobes, attaining sometimes ½-inch opening in two thickly coriaceous valves. Seeds completely enveloped in the arillus.

Geographical Range.

Brushes of Coastal Queensland and Northern New South Wales.

Nephelium leiocarpum, Benth.

TIMBER.

Description and Uses.

The timber of this tree has a very light brown colour, shading into yellow, very similar to *N. foveolatum*, but not so hard and more open in the grain. May be found suitable for various constructional purposes.

H. = Hard. W. = 52 lb. per cubic foot.

Systematic.

A tall tree, with smooth pale variegated bark, usually glabrous, except very slightly to pubescent on the young leaves and shoots, and sometimes on the panicles. Leaflets two to six, mostly oblong-elliptical, ovate-lanceolate or lanceolate, acuminate or obtuse, 2 to 3 or even 5 inches long, but more variable in size and shape than in most species, entire or rarely with a few deep serratures narrowed into a very short petiolule, not coriaceous, the rachis angular. Flowers in loose panicles, not much branched, usually glabrous. Calyx about 1 line diameter, with very short broad teeth. Petals broad and short, but variable. Fruit sessile or nearly so, glabrous, with distinct globular lobes of 4 to 5 lines diameter, coriaceous, indehiscent or opening irregularly in a longitudinal slit, or breaking off transversely. Seeds enclosed in the arillus.

Geographical Range.

Coast districts of New South Wales and East Coast of Queensland and Islands.

Nephelium Lauterianum, Bail.

TIMBER.

Description and Uses.

According to F. M. Bailey, Q. Fl., Vol. I, p. 305, this is somewhat similar in character to *Heterodendron oleæfolium*, the outer wood being grey and the inner brown. It is close grained, hard, and heavy, but easily worked; useful for mallets and tool handles.

Systematic.

A tall, erect tree, with umbrageous head, trunk attaining a diameter of 1½ to 2 feet, bark smoothish. Leaves attenuate, pinnate glossy, narrow-lanceolate in outline, leaflets very irregular, alternate, about ten on adult trees, linear-lanceolate, about 5 inches long, 1 inch wide, larger on the young trees; margins entire or obscurely toothed in the upper half. Flowers minute in slender widely-branching panicles near the summit of the branchlets, inserted shortly above the axils. Calyx of five ovate lobes. Petals white. Capsule glabrous, depressed, prominently stipitate, attaining to a diameter of 1 inch of three rounded lobes, glabrous inside, except for a small dense tuft of white hairs immediately below where the ovules are attached. Seeds compressed, smooth, angular, entirely concealed in a thick fleshy arillus of an amber colour, very juicy and of sharp acid flavour.

Geographical Range.

Eudlo scrubs, Queensland.

Castanospora alphandi, F.v.M.

TIMBER.

Description and Uses.

A large tree, yielding a very palish brown, fairly hard, straight grained, rather close timber with no figure, but nevertheless it would look well in panelling and some forms of cabinet work, house building, and should be useful for general purposes as a hardwood.

H. = Moderate. W. = 49 lb. per cubic foot.

Systematic.

A large tree with pinnate leaves. Calyx five-toothed. Flowers racemose-paniculate. Leaflets four to ten, lanceolate or ovate-lanceolate, entire, glabrous and shining above, hoary-tomentose underneath. Petals rhomboid-ovate, shortly clawed, scarcely exceeding the calyx. Fruit indehiscent, depressed globular, often cordate, smooth, coriaceous, rarely exceeding 1 inch. Seeds chestnut brown, without arillus.

Geographical Range.

New South Wales, Northern brush forests. Queensland, borders of creeks, tropical Queensland, Rockingham, Johnstone, Mulgrave, the Barron and other river scrubs.

Diploglottis Cunninghamii, Hook.f.

"TAMARIND." Plate 21.

TIMBER.

Description and Uses.

This is one of the finest timbers of the Sapindaceæ, being very similar in colour and texture to *Cupania pseudorrhus*. The wood is light grey in colour, darkening to light brown towards the centre; hard, close grained, but has very little figure. It could be used for carriage building, coach and cabinet work, or for various forms of constructional undertakings.

H. = Moderate. W. = 40 lb. per cubic foot.

TRANSVERSE TEST OF TIMBER.

(The following was made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

Breaking load in lb.	6,600
Modulus of rupture in lb. per square inch...	13,930
„ elasticity „ „ ...	1,937,800
Rate of load in lb. per minute	942

Systematic.

A brush tree, the young branches, petioles and inflorescence densely clothed with a soft rust-coloured tomentum. Leaves very large, sometimes exceeding 2 feet; leaflets eight to twelve, opposite or irregularly alternate, oblong-elliptical or ovate-lanceolate, acute or obtuse, usually 6 to 8 inches, but sometimes above 1 foot long, glabrous above, pubescent underneath, with raised parallel pinnate veins. Flowers numerous, short on pedicels, clustered along the branches. Calyx very short, rusty-tomentose. Petals about as long as the calyx, orbicular, thin, ciliate. Fruit about ½ inch diameter, tomentose.

Geographical Range.

The Coastal districts of New South Wales and Queensland.

Atalaya hemiglauca, Benth.

"WHITEWOOD."

TIMBER.

DESCRIPTION AND USES.

This is one of the finest and most attractive hardwoods of the country, the colour being a pale canary yellow, and the texture very close with very fine rays. The small sapwood is prone to the attacks of a borer. It is hard and bony to work, but polishes well, and could be used for machine bearings, heavier parts of carriage work, as well as the decorative portion, and so could also be classed as a cabinet timber.

H. = Hard. W. = 49 lb. per cubic foot.

Systematic.

A tall shrub or small tree, quite glabrous, except the flowers, and more or less glaucous. Leaves usually pinnate. Leaflets few, from narrow oblong to linear, obtuse or scarcely acute, from 2 or 3 to 7 or 8 inches long, often somewhat falcate, narrowed at the base, but rarely petiolulate, rigidly coriaceous, with numerous pinnate and reticulate veins, and a somewhat thickened margin. The common petiole terete, or nearly so; sometimes, however, the petiole becomes winged, or the leaves are quite simple, oblong or linear, or the leaflets are decurrent on the petiole forming a large two or three lobed leaf, or rarely the simple leaf is ovate-lanceolate, and 8 to 10 inches long. Flowers in dense panicles. Samarae pubescent with minute appressed hairs 1 to 1½ inch long, including the wing, which is nearly as broad as long, the cavity hairy or nearly glabrous inside.

Geographical Range.

This Species has a very extensive range as it is found on the Eastern Coast of Queensland, New South Wales, and away into the centre of the continent to Cooper's Creek.

Heterodendron oleæfolium, Desf.

TIMBER.

DESCRIPTION AND USES.

This is a hard, close, straight-grained timber with a very dark brown heartwood and a lighter coloured outer portion. It is suitable for engraving or any purpose to which the Boxwood is applicable.

H. = Extremely hard. W. = 78 lb. per cubic foot.

Systematic.

A medium-sized tree. The young shoots hoary or glaucous, with a minute silky pubescence. Leaves linear, lanceolate or narrow oblong, rarely almost obovate, acute or obtuse, 2 to 4 inches long, quite entire, narrowed into a very short petiole, coriaceous and sometimes very rigid. Panicles usually few flowered and much shorter than the leaves. Calyx broadly cup-shaped, varying from 1½ to nearly 3 lines diameter. Ovary usually three or four-celled, densely tomentose. Fruit of one, two, or very rarely three or four nearly globular lobes, 3 or 4 lines in diameter.

Geographical Range.

Found in all the States of the Commonwealth.

PLATE 21

TAMARIND.

(*Diploglottis Cunninghamii*, HOOK.)

PLATE 22.

YELLOW CEDAR.

(*Rhodosphera rhodanthema*, ENGLER.)

NATURAL ORDER.

Anacardiaceæ.

An Order with a fairly extensive distribution in the tropics and sub-tropics, and famous for many of its economics, but the timber is, perhaps, the least known of them. *Rhodosphæra rhodanthema*, Engl., the Yellow Cedar, is a beautiful timber, and might be used by cabinet makers and others in greater quantity. The few Australian species have mostly a hard wood.

Species Illustrated in Colour :—

Rhodosphæra rhodanthema, Engl. (Yellow Cedar).

*Rhodosphæra rhodanthema, Engl.

"YELLOW CEDAR."

TIMBER.

Description and Uses.

This timber is seldom found on the market, but its bright yellow colour should create for it something of a demand, as it is very decorative. Such a timber could be utilised in various trades, being hard, fairly heavy, close grained, and dresses easily, as well as taking a good polish. It could be used for cabinet work, panelling, interior carriage decorative work, marquetry, and many other branches of timber economics.

H. = Moderate. W. = 47 lb. per cubic foot.

Anatomical Features.

A very regularly constructed timber, the fibres running in radial rows parallel to the rays; having walls of medium thickness with a lumen a third the diameter of this wood element; the perforations were not distinctly discernible. The only instance seen of septate fibres of

FIG XXIX.

CROSS SECTION, showing in parallel lines, the rays and fibres. The walls of the pores have been displaced in cutting.

Micro. photo.]

RADIAL SECTION, showing homogeneous rays, in which a crystal was found in nearly every cell.

[*T. C. Roughley*

TANGENTIAL SECTION, showing a uniformity of structure. The dark spots in the rays are mostly crystals.

RHODOSPHÆRA RHODANTHEMA, ENGL.

"YELLOW CEDAR."

the species micro-sectioned. Parenchyma of the wood rare, but the rays numerous, and these are especially interesting as nearly all the cells contain the monoclinic crystals already described and figured in Part I, and in no other instance were they found to be so numerous in the rays, which are mostly two cells wide and a few in height, and also contained some silica. The vessels have rather thin walls—the chief feature of these organs is the polygonal figures surrounding the pits.

Systematic.

An average forest tree of the Coastal brushes, less than 100 feet in height, generally having a smoothish, flaky brown bark. Leaves pinnate, with a round petiole or stalk; leaflets from seven to nine, oblong, obtusely acuminate, entire, shortly petiolate, venation distinct on the underside, where also occur stomata. Flowers large, red-coloured, in dense panicles, dioecious, very shortly pedicellate. Sepals very small, broadly ovate, very obtuse. Petals very small, recurved, ovate. Stamens ten; styles three, short, thick, diverging with capitate stigmas. Fruit a globular drupe, shining, under 1 inch in diameter. Seeds orbicular, flat.

Geographical Range.

A brush tree of the East Coast districts of New South Wales and Queensland.

Semecarpus Australiensis, Engl.

TIMBER.

Description and Uses.

F. M. Bailey's description, Q. Fl., Vol. I., p. 324, of this wood is that it is yellow in colour with brown markings and easy to work, strong and tough, and might be used in cabinet work.

Systematic.

A spreading-headed medium or large tree. Branches thick, with grey bark, the branchlets rough with lenticels. Leaves broadly obovate, very obtuse, 3 to 6 inches long, entire or lanceolate and 9 inches long, cuneate at the base, on very short petioles, glabrous above, hoary or white underneath, but scarcely tomentose, the pinnate veins and reticulate veinlets conspicuous on both sides, and a very prominent nerve-like margin. Flowers very small in pyramidal panicles, sessile and clustered. Bracts $\frac{1}{2}$ to 1 line long. Calyx very short. Petals scarcely 1 line long. Ovary minute and rudimentary or reduced to a tuft of hair. Female flowers sometimes larger than the male. Calyx-lobes $\frac{1}{4}$ inch long. Petals $1\frac{1}{2}$ line long and almost 1 line broad. Stamens in female flowers shorter than the petals. Fruit oblique-conoid, compressed. 1 to $1\frac{1}{2}$ inch diameter, and about thick, rugose, supported upon a large fleshy succulent pedicel, the nut surrounded inside near the margins by a row of oil cells.

Geographical Range.

The Coastal districts of Queensland and Torres Straits.

Plieogynium Solandri, Engl.

"BURDEKIN PLUM."

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey's description, Q. Fl., Vol. I., p. 324, of this wood is that it is hard, dark brown in colour, with red markings (resembling American Walnut). The grain is pretty, close and straight. An excellent wood for the joiner or cabinet maker and is suitable also for turning.

Systematic.

A tree of medium size, frequently unisexual; the branchlets and foliage from velvety pubescent to nearly glabrous. Leaves 3 to 7 inches long, on petioles of about 1 or 2 inches long; slightly angular as well as the rhachis: leaflets petiolulate, of from two to five pairs, and a terminal odd one, oval-oblong, 2 to 4 inches long, and except the end one, which has a rather long cuneate base, very oblique at the base. A cavity at the axil at the midrib. Panicles (the male about 5 inches long with abortive ovary) slender, narrow and drooping, the flowers with a few short branches, in small clusters along the branches, females usually in spikes not exceeding 2 inches, with short stamens and sterile anthers. Calyx segments roundish, scarcely exceeding ¼ line long. Petals yellowish-green, about 1 line long, subovate, veined, glabrous above. Fruit turbinate from 1 to 1½ inch or more in diameter, often of a deep purple when ripe, and then with a juicy sarcocarp: putamen hard, rugose outside, twelve-celled, containing one seed in each cell.

Geographical Range.

North-east Coastal districts of Queensland.

NATURAL ORDER.

Leguminosæ.

THIS is a very extensive Order and has representatives in almost all parts of the world, the number of species numbering some thousands, those of Australia even running into hundreds, and most of these yield timbers which are very ornamental and eminently fitted for cabinet work, although ranked as hardwoods, some of them particularly so, as *Acacia pendula*, Myall; *A. excelsa*, Ironwood; *A. Cambagei*, Gidgea, and many others. *A. melanoxylon*, Blackwood, has the widest commercial reputation of them all, a circumstance hardly to be wondered at when, as a decorative wood, it probably has no equal in the world.

They are nearly all dark-coloured timbers, the exception being *A. Maideni* and *A. Bakeri*, and only a few rank as soft, such as *A. dealbata*.

SPECIES ILLUSTRATED IN COLOUR :—

Castanospermum australe, A. Cunn. (Black Bean).
Acacia salicina, Lindl. (Eumung).
A. harpophylla, A. Cunn. (Brigalow).
A. melanoxylon, R.Br. (Blackwood).
A. Maideni, F.V.M. (Scrub Hickory).
A. Bakeri, J. H. Maiden (Hickory).
A. Cambagei, R. T. Baker (Gilgea).
A. pendula, A. Cunn. (Myall).

Castanospermum australe, A. Cunn.

"BLACK BEAN." Plates 23 and 24.

TIMBER.

DESCRIPTION AND USES.

This is one of the finest specimens of cabinet hardwood, and a beautiful brush tree of big dimensions. The chief characteristic of the wood is its beautiful figure, even when the grain is straight, and its fine dark walnut colour; hence as a cabinet timber its value ranks high.

It is open grained, the vessels being numerous, of wide lumen, and evenly scattered throughout the wood elements, hence when cut longitudinally these appear as light streaks on a chocolate ground. The grain is straight, and thus it planes easily with a nice smooth surface, and so polishes well. In some features it is superior to Walnut (*Juglans*).

Being a figured timber it would be most advantageously used in cabinet work in veneers, and used in the solid would be very suitable for billiard tables. Another avenue of technology that might be mentioned is wood carving. Requires careful seasoning.

H. = Moderate. W. = 47 lb. per cubic foot.

ANATOMICAL FEATURES.

The fibres have a comparatively large lumen, occasionally filled with a brown deposit. The vessels are fairly numerous, conjugate, and surrounded (often in crescent shape) by wood parenchyma and tracheids; the cells are small, and the wall perforations are all bordered by polygonal figures.

The rays are numerous but small and few cells high and two wide.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	6,380	7,260
Modulus of rupture in lb. per square inch...	13,150	14,972
,, elasticity ,, ,, ...	1,850,700	1,828,200
Rate of load in lb. per minute	1,063	1,037

Systematic.

One of the large trees of the coastal brush lands distinguished by its large pinnate leaves and big pod. Bark thin, compact, pale-coloured, smooth. Leaves from 1 to nearly 2 feet long; leaflets eleven to fifteen, ovate, elliptical or broadly oblong, shortly acuminate, up to 6 inches long, shortly petiolate. Flowers large, orange-coloured, in loose axillary or lateral racemes, under 6 inches long, occurring sometimes on the trunks and branches removed from the leaves; standard about 1 inch in diameter. Pod 8 or 9 inches long, about 2 inches broad, three to five cells, each containing a large chestnut-like seed.

Geographical Range.

A native of the brushes of the North Coast districts of New South Wales and Southern Queensland.

PLATE 23.

BLACK BEAN.

(*Castanospermum australe*, A. CUNN.)

PLATE 24.

BLACK BEAN.

(*Castanospermum australe*, A CUNN.)

FIG. XXX.

CROSS SECTION, showing unusual arrangement of wood parenchyma around the pores. The dark portions are the fibres.

Micro. photo.]

RADIAL SECTION, cut through two heterogeneous rays (top and bottom of plate); the two columns of cells are wood parenchyma. In the centre (square) are fibres in tiers.

[*T. C. Roughley.*

TANGENTIAL SECTION, the mass of cells to left of centre is wood parenchyma with rays running through it. To right is a vessel showing ordinary bordered pits and septa walls between the cells.

CASTANOSPERMUM AUSTRALE, A. CUNN.

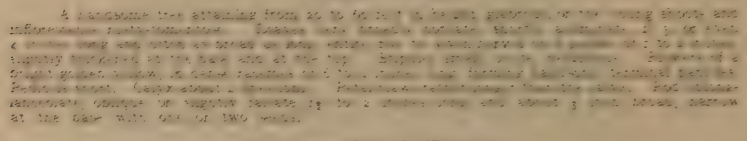
Barklya syringifolia, F.v.M.

TIMBER.

Description and Uses.

Briefly, the wood is blackish-grey, close in grain, very tough, and suitable for tool handles. (F. M. Bailey Q.Fl., Vol. II, p. 449.)

Systematic.



Geographical Range.

Near Brisbane, Rockhampton, and Wide Bay.

Cassia Brewsteri, F.v.M.

"CIGAR TREE."

TIMBER.

Description and Uses.

A very fine hardwood timber of a pale, pink colour and a pale yellowish sapwood. It has a fairly compact texture, but the numerous vessels give the appearance of a rather open grain in longitudinal sections; has no figure, although the colour is rather pleasing. It is not too heavy for cabinet work, and altogether is an excellent hardwood, and suitable for general purposes.

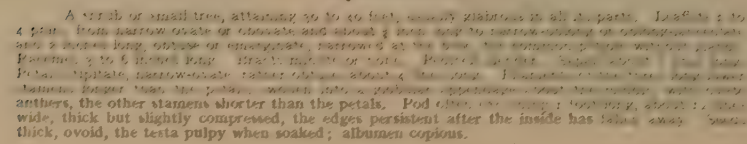
H. = Moderate. W. = 52¾ lb. per cubic foot.

Bailey records two varieties of this species, viz.:

'*a*, *Marksiana*, and states that this tree yields a timber of a pinkish colour, close grained and tough.

'*b*, *sylvestris*, which has a wood of a golden-brown colour, close-grained, and would be likely to resist the attack of white ants on account of its intense bitterness; a valuable wood for building and cabinet work.

Systematic.



Geographical Range.

Hilly pastures and river banks on the Burdekin, Rockhampton, Port Denison, and Fitzroy River, Clermont, Queensland; and North Coast, New South Wales.

Bauhinia Hookeri, F.v.M.

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey records, Q. Fl., Vol. II., p. 466, this wood to be in the outer portion of a light-brown, the inner dark-brown, nicely marked, hard, heavy, and close-grained; very suitable for cabinet work.

Systematic.

A large tree, with a spreading head, usually quite glabrous. Leaflets quite distinct, very obliquely and broadly ovate or obovate, very obtuse, ½ to 1½ inch long, finely five to seven nerved, with a small [illegible] connecting the petiole between them. Flowers [illegible] in short terminal racemes [illegible] calyx glabrous or [illegible] long or with more. Petals [illegible] equal [illegible] ½ inch long, slightly villous outside near the base. Pod stipitate, flat, 2 to 4½ inch broad.

Geographical Range.

Broadsound, Gilbert River, Suttor River, Rockhampton, Islands of Torres Straits.

Bauhinia Carronii, F.v.M.

"PEGUNNY."

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey states, Q. Fl., Vol. II, p. 467, that this wood is light-brown, becoming much darker towards the centre, hard, heavy, with a close grain; suitable for cabinet work.

Systematic.

A tree, with the foliage and inflorescence of *B. Cunninghamii*, & with rather narrower leaflets, but undistinguishable without the flowers or fruit, both of which are unknown. Calyx sparsely tomentose, about ½ inch long, the dark-coloured base [illegible] the tube, portion above, the sinus (slight), very shortly bi-cleft. Petals obovate, white outside, the lower ones exceeding the calyx by about ½ inch, the others rather shorter. Stamens and pistil of *B. Cunninghamii*. Pod coriaceous, not quite 1½ inch broad, the valves coriaceous slightly convex when ripe.

Geographical Range.

On the Burdekin, Georgina River and in the interior of Queensland.

*Afzelia australis, Bail.

"JOHNSTONE RIVER TEAK."

TIMBER.

DESCRIPTION AND USES.

Mueller records this species in his census of Australian Plants as *A. bijuga*, but Bailey points out in his Queensland Flora, Vol. II, p. 468, that the two are quite different and describes the wood as brown colour, rather coarse in the grain, hard and heavy, but easy to work, and would be well adapted for house-building work, or might suit the cabinet maker.

Systematic.

A lofty tree, attaining a height of over 100 feet, with an erect trunk over 2 feet in diameter; bark covered by rather large lenticellæ, and the bark of the trunk exfoliating by hard thick oval or oblong patches, similar to some *Flindersias* and the Red Cedar; wood very hard and durable, of a reddish-brown. Leaves alternate, glabrous, of two or three pairs of very obtuse nearly orbicular leaflets from 3 to 5 inches long and nearly as broad, very unequal-sided at the base, on petiolules of about ¼ inch, the divergent almost parallel veins joining far within the margin, and forming an intramarginal one, the netted veinlets numerous and somewhat prominent. Flowers pubescent. Calyx-tube ribbed, about ¼ inch long; lobes very unequal and much imbricate, slightly longer than the tube. Petal orbicular, undulate, veined, on a claw about as long as the calyx-lobes. Pod oblong, 6 to 7 inches long and over 2 inches broad, glabrous, coriaceous, with transverse veins. Seeds dark-brown, three or four, very flat, more or less covered by a mealy substance, oblong or orbicular, about 1¼ inch diameter, the short funicle expanding into an oblong appressed aril.

Geographical Range.

Johnstone River, Queensland.

Cynometra ramiflora, Linn.

TIMBER.

DESCRIPTION.

Wood of a light-brown colour, close-grained and tough (Bailey, Q.Fl., Vol. II, p. 469).

Systematic.

A tree either glabrous or the young shoots and inflorescence rusty-pubescent. Leaflets in the Australian specimens two pairs, or rarely one pair only, obliquely obovate-oblong, very obtuse or shortly and obtusely acuminate, coriaceous, penniveined, the terminal ones 2 or 3 inches long, the lower ones smaller. Flowers in very short axillary racemes or clusters. Bracts dry, concave, at first imbricate, but very deciduous. Pedicels 2 to 3 lines long. Calyx and petals not 2 lines long. Stamens ten, rather longer. Fruit as broad as long, very thick and fleshy, ½ to ¾ inch long and very rugose in the dried specimens, probably larger and smoother when fresh.

Geographical Range.

Tropical Beaches, Queensland.

Acacia Species.

THIS Genus numbers over some 300 species in Australia alone, and probably no more cosmopolitan group of trees and shrubs exists in the world, for it is already the national flower of two continents—Africa and Australia.

Naturally in so numerous a family, a great variety of timbers is found. In Australia they range from extremely hard, heavy, and almost black, as in *A. pendula*, Myall, to light in colour and weight as in *A. Maideni*.

The darkest coloured, heaviest and hardest are *A. pendula*, Myall; *A acuminata*, Raspberry Jam; *A. Cambagei*, Gidgea; *A. homalophylla*, Yarran, *A. harpophylla*, Brigalow; *A. excelsa*, Ironwood; *A. aneura*, Mulga.

Those of a reddish colour and hard are *A. penninervis*, Mountain Hickory; *E. salicina*, Eumung; *A. fasciculifera*. Yellow-coloured and hard, *Acacia Bakeri*, Hickory.

The timber of greatest commercial value amongst the Acacias is *A. melanoxylon*, and the cause of this is not far to seek when one views the magnificent furniture and joinery work made from it, and it is probably no exaggeration to say that no timber in the world has such a variety of unique and gorgeous figures as this wood.

It is rated as a hardwood, and the mechanical test places it in this class.

A. pendula, *A. excelsa*, and *A. implexa* are very hard and are greatly appreciated in the district where they thrive, the former is much in request for glove boxes owing to its aroma, as also is *A. acuminata*, and for mounting silversmith's work. *A. Bakeri* has only just come into the market and is now being used in railway carriage work in Victoria.

All the species are not trees, many being shrubs, and often small ones at that. Probably there are several others than those described here, but not yet recorded, which yield an equally good hardwood.

The following species of Acacia are only medium sized trees, yielding a timber of very similar qualities to those above mentioned, and are not specifically

described. The timber is heavy, very close and often interlocked in the grain, ranging in colour from dark-coloured to almost black or dark red, and useful for similar commercial purposes as their congeners, *A. pendula, A. Cambagei, A. homalophylla, A. harpophylla.*

Acacia fasciculifera, F.v.M.
A. neriifolia, Benth.
A. stenophylla, A. Cunn.
A. complanata, A. Cunn.
A. torulosa, Benth.
A. Cunninghamii, Hook.
A. aneura, F.v.M.

Acacia salicina, Lindl.

"EUMUNG." Plate 25.

TIMBER.

DESCRIPTION AND USES.

As regards its ornamental character, this species of timber is a rival to *Acacia melanoxylon*, Blackwood, and often has very beautiful, large, wavy markings. In texture it is more open than Blackwood, but has about the same specific gravity, although it has a less showy figure, while the colour is somewhat like Honduras Mahogany. It is interlocked, and so it is necessary to use the scraper to produce a smooth surface before polishing. A rich appearance is produced when polished, and it would look handsome in panels, counters, interior decoration of railway carriages, and would also be very suitable for all kinds of fancy boxes, brushes, serviette rings, cutlery cases, caskets, &c. A good golf-head wood. (C. W. Chapman.)

H. = Moderate. W. = 48 lb. per cubic foot.

Systematic.

One of the largest of the Acacia family, probably the largest species of the interior, as it attains quite full tree size with a diameter of over 2 feet, branches often pendulous, branchlets angular, but soon terete. Phyllodes pale-coloured or glaucous, straight or falcate, narrow to broadly lanceolate, narrowed towards the base, 3 to over 6 inches long, occasionally over ½ inch broad, but mostly much narrower, midrib prominent, lateral veins not prominent, gland wanting. Racemes sometimes as long as the leaves, often reduced to one head on slender peduncles, about twenty flowers in each globular head. Calyx short, petals quite smooth. Pod straight or curved, 1 to 3 inches long, under ¼ inch broad, not much constricted between the seeds; valves hard and thick. Seeds orbicular, longitudinal; funicle red, forming several folds under the seed.

Geographical Range.

Open forest lands on the Balonne and Suttor Rivers, Queensland, to the Lachlan River, Barrier Range, and Western Plains, New South Wales; Victoria, South Australia, Western Australia.

PLATE 25.

EUMUNG.

(*Acacia salicina*, LINDL.)

PLATE 26.

BRIGALOW.

(*Acacia harpophylla*, A. CUNN.)

*Acacia penninervis, Sieb.

TIMBER.

Description and Uses.

This is one of the finest hardwoods of the Genus and almost identical in character, texture, and colour to *A. melanoxylon*, "Blackwood," and one description applies equally to the other, although perhaps this is a little harder than its congener.

H. = Hard. W. = 51 lb. per cubic foot.

Systematic.

A tree attaining sometimes 40 feet, but usually smaller, glabrous in all its parts in the common variety, with angular branchlets. Phyllodia from oblong to lanceolate-falcate, more or less acuminate, usually 3 to 4 inches long, but sometimes twice that length, much narrowed towards the base. One-nerved and more or less prominently and finely penniveined, the margins usually nerve-like, and often but not always a short secondary nerve terminating in a marginal gland much below the middle. Racemes rather short but loose, with several small globular heads of about twenty flowers, mostly five-merous. Pod flat, straight or curved, with slightly thickened margins, often 4 or 5 inches long, nearly ½ inch broad. Seeds ovate, longitudinal; funicle long, dilated and coloured nearly from the base, extending round the seed and bent back on the same side, so as to encircle it in a double fold.

Geographical Range.

This species has an extensive range throughout the Coast districts of the Eastern States, Victoria and Tasmania.

*Acacia Bakeri, J.H.M.

Plate 26a.

TIMBER.

Description and Uses.

In the trade this is known as Hickory—a name given to a number of trees. In colour it somewhat resembles *Flindersia australis*, Teak, but is more open in the grain than that timber, and the vessels having a larger lumen give it this appearance, when cut in the long axis. It is heavy, hard, and suitable for carriage framing, coach building, machine bearings, turnery, and, when cut with the rings, a splendid decorative figure is obtainable for panelling, veneering, &c. Sapwood affected by borers.

H. = Hard. W. = 54 lb. per cubic foot.

Systematic.

This is the giant amongst the family of Australian Acacias, as it is stated to reach over 200 feet in height, bark moderately smooth, branchlets somewhat flattened. Phyllodia sessile, broad-lanceolate, much narrowed towards each end, obtuse, usually 3 to 4 inches long and 1 inch broad, but sometimes much larger. Three-nerved, with an occasional short one terminating in a gland near the base, penniveined between the nerves, margins thickened and undulate, thin-coriaceous. Peduncles slender, 6 lines long, mostly in clusters of three to ten, forming axillary racemes mostly exceeding the phyllodia, bearing small loose heads (about twenty) of few, pale-coloured flowers, mostly four-merous. Calyx short, pubescent or softly villous. Pod straight, flat, about 8 inches long, ½ inch broad, thin, very slightly contracted between the seed. Seeds flat, ovate longitudinal; funicle short and filiform, neither folded nor enlarged.

Geographical Range.

North Coast, New South Wales, and South Coast districts, Queensland.

Acacia binervata, DC.

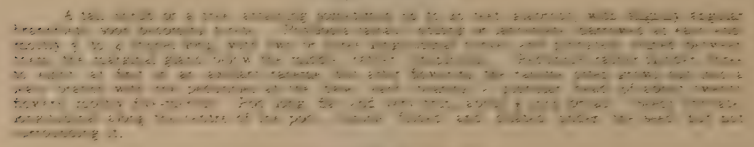
TIMBER.

Description and Uses.

A hard timber with a grey-coloured outer portion and a dark brown centre, close-grained and tough. It does not show a prominent sapwood like most Acacias, and is inclined to be knotty, but may be suitable for certain parts of waggon, coach work, tool handles, and similar trade purposes.

H. = Very hard. W. = 56 lb. per cubic foot.

Systematic.



Geographical Range.

The East Coast districts of New South Wales.

*Acacia homalopyhlla, A. Cunn.

"YARRAN."

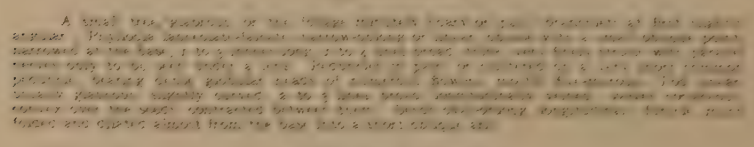
TIMBER.

Description and Uses.

An extremely hard, close-grained timber, of a very dark brown colour resembling *Acacia pendula* both in colour and texture, but of more pronounced figure. Like most of the Acacias, it has a narrow, white sapwood about ½ inch in width. The timber can be worked up to a nice surface and polishes well. It should be suitable for pulley sheaves, dead eyes, machinery bearings, veneers, ornamental cabinets, or for any purpose requiring a strong, hard wearing timber.

H. = Extremely hard. W. = 84 lb. per cubic foot.

Systematic.



Geographical Range.

Abundant in the interior of New South Wales. Salt-bush flats on the Murray, Victoria.

Acacia implexa, Benth.

TIMBER.

DESCRIPTION AND USES.

A dark-coloured, very hard, close-grained, interlocked wood, much resembling *A. acuminata* in texture and features. Useful for heavy cabinet work, machine bearings, coach and carriage work, pulley-blocks and other purposes requiring strength and wearing qualities.

H. = Very hard. W. = 64½ lb. per cubic foot.

Systematic.

A glabrous tree, sometimes slightly glaucous; branchlets terete or nearly so. Phyllodia lanceolate-falcate, more acuminate, more narrowed at the base and thinner than *A. melanoxylon*, mostly 5 or 6 inches long or more, with several slender longitudinal nerves and fine veins. Peduncles few, in a very short raceme, more slender then in *A. melanoxylon*, bearing each a small dense head of numerous flowers, mostly five-merous. Pod narrow-linear, much curved and twisted, 2 or rarely nearly 3 lines broad, contracted between the seeds. Seeds ovate-oblong, longitudinal; funicle dilated and coloured almost from the base, much folded under the seed, but not encircling it.

Geographical Range.

Moreton Bay, Dawson, and Burnett Rivers, Queensland, and coast of New South Wales.

*Acacia harpophylla, F.v.M.

"BRIGALOW." Plate 26.

TIMBER.

DESCRIPTION AND USES.

This species differs in one respect from many of their congeners, being of a gregarious nature, and the term "Brigalow" scrub is common over a fair area of the States of New South Wales and Queensland. The timber is dark-coloured, but paler than *A. pendula*, and straighter grained; the figure is more pronounced or clearly seen; hard, heavy, and suitable for heavy work of a medium size, as only on rare occasions does it reach large dimensions. The remarks concerning "Myall" are in a measure applicable to this timber, but it is lighter in weight than that wood. It is used for general purposes in the district where found.

H. = Hard. W. = 63 lb. per cubic foot.

Systematic.

A fair-sized tree found well to the west of the Eastern Coast Range, with a hard, compact furrowed bark. Phyllodia pale or glaucous, varying in length from 3 to 9 inches, narrowed at both ends, coriaceous, pale or glaucous, with several veins fairly well marked. Inflorescence in axilliary clusters with slender peduncles under 1 inch long, the globular head of flowers containing about twelve to fifteen flowers. Pods narrow, under 6 inches long, constricted between the seeds oval; arillus short and straight.

Geographical Range.

Interior of New South Wales from the Lachlan River to the Barrier Range; also in Victoria and Queensland.

Acacia excelsa, Benth.

"IRONWOOD WATTLE."

TIMBER.

DESCRIPTION AND USES.

This wood is in the same class as *A. pendula* in most qualities, but is a little lighter in colour, and is obtainable in larger sizes, whilst the figure is more clearly seen, and in this respect it resembles *A. melanoxylon* in some figurings. It is very hard, close grained, interlocked, and suitable for similar economics as others of the Myall and Blackwood class—a good wood for turnery.

H. = Very hard. W. = 63 lb. per cubic foot.

Systematic.

A large forest tree; branchlets slender, terete or nearly so, glabrous or rarely minutely pubescent. Phyllodia oblong-falcate, rather obtuse or mucronulate, narrowed at the base, 2 to 3 inches long, $\frac{1}{4}$ to $\frac{3}{4}$ inch broad, thinly coriaceous, with five to seven nerves, and smooth or faintly veined between them. Peduncles solitary, in pairs or clusters, sometimes not 2 lines, in other specimens nearly $\frac{1}{4}$ inch long, bearing each a globular head of numerous (twenty to thirty) flowers, mostly five-merous. Pod straight, flat, about 3 lines broad, thinly coriaceous, the sutures narrow-edged or almost winged, not usually dehiscent but hardening over the seeds and readily breaking off between them. Seeds ovate, longitudinal; funicle short and filiform, neither folded nor enlarged.

Geographical Range.

Interior of Queensland and New South Wales.

*Acacia melanoxylon, R.Br.

"BLACKWOOD." Plate 26b.

TIMBER.

DESCRIPTION AND USES.

This is probably one of the most gorgeously figured woods in the world. As a cabinet timber for all-round usefulness it might, perhaps, be placed next to *Cedrela Toona*, Red Cedar, and its utilisation in this connection dates far back in Australian timber technology. It is made into beautiful furniture, as it takes a good polish, which gives it a satiny sheen, thus enhancing its often ornamental figure. It is fairly close-grained, strong, and dresses with a beautiful finish. Apart from its utilization for furniture and cabinet work, it has also been tried for gun-stocks and given satisfaction. It is extensively used in the construction of railway passenger cars, office, bank, and shop fittings, billiard tables, also interior joinery work of ships' cabins, in fact, almost every purpose to which a good cabinet timber can be utilized. The Central Railway Booking Office fittings, Sydney, are made from it. Frequently found with a fiddle back and other gorgeous figures.

H. = Moderate. W. = 47 lb. per cubic foot.

PLATE 26A.

HICKORY.

(*Acacia Bakeri*. J.H.M.)

PLATE 26B.

BLACKWOOD.

(*Acacia melanoxylon*, R.Br.)

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	6,500	6,500	6,000
Modulus of rupture in lb. per square inch...	12,701	12,504	11,960
,, elasticity ,, ,, ...	.....	.....	.....
Rate of load in lb. per minute	722	650	600

Systematic.

This is one of the largest trees amongst Acacias, as it attains a height of 80 or 100 feet with a good diameter. Bark hard, rough, furrowed, and of a compact texture. Phyllodia straight, lanceolate or falcate, up to 6 inches in length and ½ to 1 inch broad, much narrowed towards the base, with several longitudinal nerves and numerous anastomosing veins. Inflorescence either on a solitary peduncle or a short raceme. Flowers in head of forty or fifty. Pods flat, much curved about ½ inch broad with thickened margin. Seeds orbicular; funicle red, encircling the seed in a double fold.

Geographical Range.

A widely distributed timber species, as it is found in Tasmania, Victoria, New South Wales, and Queensland.

*Acacia pendula, A. Cunn.

"MYALL." Plate 27.

TIMBER.

Description and Uses.

An aromatic timber, and one of the hardest and heaviest of the Acacias, although only used for decorative work, being in this feature a rival to the famous Black Oak of the Old Country, so much in vogue in the 15th and 16th centuries, and even later. It is close in texture, not too distinctly figured, polishes well, and should be very suitable for turnery, as it makes splendid handles of all kinds, bowls, mauls, &c. It could also be utilised for small ornamental articles, such as cutlery cases, glove boxes, &c., and makes a splendid background with silver or gold mountings.

H. = Extremely hard. W. = 72 lb. per cubic foot.

Anatomical Features.

The chief characteristic of this timber is the presence of deposits, both amorphous and crystalline, found in the cavities of all the wood elements.

The crystalline substance, already described and figured, Part I, occurs in a much larger quantity than in that of any other timber examined. The crystal sacs are mostly in close proximity to the vessels or scattered amongst the wood parenchyma and fibres, but not in the rays, and the amorphous dark substance, to which is probably due the colour of the wood, fills most of the fibre lumen, ray parenchyma cells, and especially the vessels.

The fibres have very thick walls, the lumen being very small, and very thick walls are also a predominant feature of the vessels, which are also characterised by the scalariform apertures. The wood parenchyma is generally found clustered around the vessels; the ray parenchyma is numerous, a few cells high and mostly two wide.

Systematic.

An Acacia which attains tree size and is easily distinguished by its willowy character, which gives it an attractive appearance; branchlets slightly angular, soon terete. Phyllodia of a glaucous hue, linear lanceolate, falcate, acuminate, narrowed towards the base, 2 to 3 inches long, coriaceous, indistinctly finely striate, often with a recurved point. Inflorescence in short axillary racemes, each head containing from twelve to twenty flowers. Pod linear, very flat, nearly 3 inches long and ¼ inch broad, the valves reticulate, the sutures bordered by a very narrow wing. Seeds oval, placed obliquely; arillus with three or four short folds near the hilum.

Geographical Range.

From the Maranoa River, Queensland, to morasses of the Lachlan and Western Plains, New South Wales.

*Acacia Cambagei, R.T.B.

"GIDGEA." Plate 28.

TIMBER.

DESCRIPTION AND USES.

Like most Acacias of the interior, the timber is very dark coloured, close grained, and heavy. When the fibres run in short waves, it is then known as "ringed Gidgea," and this is in great request for turnery, as the wavy appearance of the wood produces a pretty figure, the undulations of light and shade being very effective. For this reason it is much in request for walking-sticks, table legs, balusters, newel posts, &c. This "ring" character occurs in many Australian trees other than the Acacias. The straight-grained timber would be very suitable for heavy cabinet work and other solid specimens of Applied Art. In the western area of New South Wales, especially at Bourke and beyond, it is fairly plentiful, and forms the principal fuel where coal is scarce.

It could be used for coach and waggon-building where strength and durability are required, and, being aromatic, is suitable for glove boxes, silver and gold smiths' casket-ware.

H = Extremely hard. W = 84 lb. per cubic foot.

Systematic.

A medium-sized tree with pendulous branchlets, the foliage of a pale or glaucose hue; branchlets angular; phyllodia falcate, lanceolate, obtuse or slightly acuminate, up to 5 inches long, and from 5 to 9 lines broad, with numerous fine parallel veins, two or three more prominent than the rest, thin or membraneous. Peduncles about 3 lines long, slender, in axillary clusters of about six, each bearing a globular head of about twelve flowers. Sepals broad, spathulate, ciliate on the upper edge, free, and less than half as long as the petals. Petals glabrous. Pod flat, straight, about 3 lines long and 4 lines broad, veined, valves thin, not contracted between the seeds. Seeds ovate, longitudinal, or slightly oblique; funicle short, filiform, not folded nor dilated.

Geographical Range.

Interior of New South Wales and Queensland.

PLATE 27.

MYALL.

(*Acacia pendula*, A. CUNN.)

PLATE 28.

RING GIDGEE.

(*Acacia Cambagei*, R.T.B.)

FIG. XXXI.

CROSS SECTION, showing conjugate pores with a dark-coloured deposit; the fibres have a particularly small diameter.

RADIAL SECTION, showing numerous crystal parenchyma: the rays all have a dark substance in the cells, seen in all the sections.

Micro. photo.]

TANGENTIAL SECTION, showing compact fibres; numerous rays and many crystal parenchyma.

[*T. C. Roughley.*

HIGHLY magnified tangential portion, showing two crystal parenchyma, tracheids between these and over a vessel.

ACACIA PENDULA, A. CUNN.

Acacia longifolia, Benth.

"SYDNEY GOLDEN WATTLE."

TIMBER.

DESCRIPTION AND USES.

A very good timber of a brown or chocolate colour, hard, heavy, straight-grained, planes easily; takes a good polish. Specimens seen show no figure, but it is nevertheless an ornamental timber, and could be used for carriage work, panelling, coach work, and probably many other economics for which it has not yet been tested.

H = Moderate. W = 41 lb. per cubic foot.

Systematic.

An erect shrub, sometimes low and bushy, but attaining often a considerable size, or growing into a small tree, glabrous or slightly pubescent when young; branchlets angular. Phyllodia from broadly oblong to oblong-lanceolate or linear, very obtuse or almost acuminate, usually narrowed towards the base, with two to five more or less prominent longitudinal nerves and conspicuously or faintly reticulate between them, varying in length from 2 to 3 inches in some varieties to 5 or 6 lines in others. Spikes axillary, loose and interrupted, flowers not imbricate, almost four-merous. Pod linear, often several inches long, 2 to 4 lines broad or rarely more; valves coriaceous, convex over the seeds, usually contracted between them. Seeds longitudinal, often distant; funicle not much folded, thickened almost from the base into a turbinate almost cup-shaped aril at the base of the seed, and sometimes nearly as large.

Geographical Range.

Moreton Bay and Southern localities, Queensland, and New South Wales Coast districts, Victoria, Tasmania, South Australia.

Acacia doratoxylon, A. Cunn.

"SPEARWOOD" OR "HICKORY."

TIMBER.

DESCRIPTION AND USES.

A timber somewhat resembling *A. melanoxylon* in general characters but heavier and has not the fine figuring of that species, more often being straight and close grained; dresses and polishes well. Suitable for heavy cabinet work, machinery bearings, carving, turnery, dead eyes, and pulley blocks.

H = Very hard. W = 52 lb. per cubic foot.

Systematic.

A tall shrub or small tree, glabrous with an ashy hue; branchlets at first acutely angular, but soon terete. Phyllodia elongated, slightly falcate, shortly acuminate, and often with oblique or recurved points, 4 to 8 inches long, 2, 3, or rarely 4 lines broad, narrowed towards the base, rather thick, with numerous fine parallel nerves, the central one more prominent. Spikes shortly pedunculate, solitary or clustered, rarely 1 inch long, rather dense. Flowers mostly five-merous Pod 3 to 4 inches long, very narrow, tapering much at the point and slightly constricted between the seeds. Seeds longitudinal; funicle twice or thrice folded and forming an aril at the base of the seed.

Geographical Range.

On the Upper Maranoa, Moreton Bay, New South Wales; parts of Western Australia, South Australia, Victoria and Queensland.

Acacia Maideni, F.v.M.

"SCRUB HICKORY." Plate 29.

TIMBER.

DESCRIPTION AND USES.

This timber is illustrated as one of the group of Acacias that differs in colour and texture from the type or main group, such as *A. pendula, A. Cambagei, A. harpophylla,* &c. It is pale-coloured, fairly hard, and comparatively light in weight, and, being a rapid grower, the annual rings are prominent, and when cut tangentially give a big figure.

Suitable for cabinet work, chair-making, carriage work, veneers or any purpose where medium strength is required. The fibres are long, the wood being of equal hardness, both transverse and longitudinal.

H = Moderate. W = 51 lb. per cubic foot.

Systematic.

A tree 50 feet high, occurring in the brush lands of the Coast. Phyllodia large, falcate lanceolate, or oblanceolate, many veined, thin. Flowers in almost sessile spikes, the spikes solitary or two or three together, their rachis tomentose. Pod narrow, compressed, much twisted. Seeds longitudinal, shining; funicle pale-reddish, almost encircling the seed in a double fold.

Geographical Range.

Southern parts of Queensland to near Sydney, New South Wales.

Acacia glaucescens, Willd.

TIMBER.

DESCRIPTION AND USES.

A dark coloured timber similar in character and uses to *A. aulacocarpa.*

H. = Very hard. W. = 62 lb. per cubic foot.

Systematic.

An erect tree attaining 60 feet or more, bark probably the thinnest in the genus sometimes not over 2 lines thick, foliage generally ashy or hoary with a very minute close pubescence, or the young shoots yellowish; branchlets more slender and much less angular than in *A. Cunninghamii.* Phyllodia oblong-falcate or lanceolate, narrowed at both ends, mostly 4 to 6 inches long, ½ to near 1 inch broad in the middle, coriaceous, striate with numerous very fine nerves, three to five rather more prominent, the smaller ones occasionally anastomising, and all free from the lower margin from the base. Spikes nearly sessile or shortly pedunculate, often clustered in the upper axils, 1 to 2 inches long. Flowers distinct or distant, mostly five-merous, but occasionally four-merous. Pod linear, much twisted or irregularly coiled; valves hard, convex, about 2 lines broad. Seeds longitudinal.

Geographical Range.

The Coastal districts of Queensland, New South Wales.

*Acacia acuminata, Benth.

"RASPBERRY JAM."

TIMBER.

DESCRIPTION AND USES.

This is one of the hardest timbers in Australia, being interlocked, heavy, close-grained, and occurring sometimes with the fiddle-back figure. It is extremely hard, and useful for heavy turnery, machine bearings, sheaves for blocks, suitable for any kind of ornamental boxes, cases, or caskets; very durable, and impervious to white ants. The common name is derived from its possessing an odour similar to the domestic *Rubus* fruit.

H. = Extremely hard. W. = 69½ lb. per cubic foot.

Systematic.

A tree of 30 to 40 feet, glabrous or the young shoots silky with an almost golden pubescence; branchlets terete or nearly so. Phyllodia long-linear, somewhat falcate, narrowed at each end, from 3 inches long and 2 or 3 lines wide to 10 inches or more long and then rarely above 2 lines wide, striate as in *A. doratoxylon* with numerous fine parallel nerves, the centre one more prominent. Spikes nearly sessile, not above 1 inch long. Flowers mostly five-merous, larger than in *A. doratoxylon*. Calyx longer in proportion and readily separating into distinct sepals. Pod linear, straight or nearly so, 2 to 2½ lines broad, flat or convex over the seeds, somewhat contracted between them. Seeds oblong, longitudinal; the last two or three folds of the funicle dilated into an aril under the seed.

Geographical Range.

Western Australia, from King George's Sound to the Swan River.

Acacia aulacocarpa, A. Cunn.

"BRUSH IRONBARK."

TIMBER.

DESCRIPTION AND USES.

A timber that should rank high amongst the best of Acacia woods, as it much resembles in character and feature *A. melanoxylon* and *A. harpophylla*, but perhaps not so hard. It lacks, however, the figure of the former, but is nevertheless a good heavy cabinet timber; useful for panelling, marquetry, veneers, turnery, also for heavy framing, carriage work, dead eyes, pulley blocks, and general uses where strength is required.

H. = Hard. W. = 56 lb. per cubic foot.

Systematic.

Slightly hoary or ashy-glaucous with a minute almost powdery down, which at length disappears; branchlets angular. Phyllodia falcate-lanceolate, narrowed at both ends, 3 to 4 inches long, about ½ inch broad, with a few slightly prominent nerves, the lower ones confluent with the lower margin at the base, and numerous smaller closely packed veins, rarely anastomosing. Spikes slender, loose, 1 to 2 inches long, tomentose-pubescent or glabrous. Pod falcate-oblong, flat but thick, obtusely recurved at the end, 2 to 3½ inches long, ½ to ¾ inch broad, much narrowed at the base, hard, obliquely veined. Seeds obliquely transverse; funicle twisted, not forming an aril under the seed.

Geographical Range.

Port Bowen, Rockhampton, Cameron's Brush, Queensland, and Northern New South Wales.

Acacia Arundelliana, Bail.

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey, Q. Fl., Vol. II., p. 515, speaks of this timber as of a light colour near the outside, pinkish towards the centre, prettily marked and close-grained.

Systematic.

A tall graceful shrub or small tree, the branches often drooping, all the young growth bristly with brown spreading hairs. Leaves oblong in outline, about 3 inches long, and 1½ inch broad, on very short petioles. Pinnæ about eighteen pairs, 1 inch long; leaflets scarcely exceeding 1 line long, very narrow, about thirty pairs. Flowers in small globular heads on filiform peduncles, in slender racemes, 5 or 6 inches long. Calyx and petals rather thick, mostly five-merous. Pod 5 inches long, ½ inch broad, scarcely contracted between the seeds; funicle expanding into an aril under the seeds.

Geographical Range.

The North Coast district of Queensland.

Acacia decurrens, Willd.

TIMBER.

DESCRIPTION AND USES.

A reddish brown coloured wood not unlike *A. melanoxylon* but not so open in the grain as *Cedrela Toona*, which, like this species, is one of the most rapid growing trees in Australia, and for this reason it is planted in some parts of the world for fuel. It planes easily and yet under mechanical test comes out as a hard timber. Straight grained. Could be used for cabinet and general work.

H. = Hard. W. = 51 lb. per cubic foot.

Systematic.

A handsome tree, glabrous, branches more or less prominently angled, sometimes almost winged. Pinnæ eight to fifteen pairs or sometimes even more, rarely reduced to five or six, leaflets very numerous (thirty to forty pairs or even more), linear, from under 2 lines to nearly 5 lines long, according to the variety. Flower heads small, globular in axillary racemes, the upper ones forming a terminal panicle. Flowers twenty to thirty in the head, mostly five-merous. Prominent midribs. Pod usually 3 to 4 inches long, about ½ inch broad or rather more, more or less contracted between the seeds. Seeds ovate.

Geographical Range.

New South Wales, Queensland, Victoria, South Australia, Tasmania.

NATURAL ORDER.

Rosaceæ.

ONE of the most widely distributed Orders over the globe, but not specially famous for its timber, and of the half dozen Genera occurring here, only one produces a hardwood, i.e., *Eucryphia Billardieri*, Spach.

*Eucryphia Billardiera, Spach.

"LEATHER-WOOD."

TIMBER.

DESCRIPTION AND USES.

Macroscopically this wood has the facies of a Kauri in texture, but not in colour, which is very pale chocolate. It is a hard, tough, close-grained timber, and has a fair figure if cut with the ring. The timber is of a very leathery nature to work, probably, hence its local name.

It appears to be very suitable for coach, carriage or cabinet work, or for building purposes requiring a strong timber.

H. = Hard. W. = 49 lb. per cubic foot.

TRANSVERSE TEST OF TIMBER.

(The following was made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

Breaking load, in lb.	9,630
Modulus of rupture in lb. per square inch...	20,055
,, elasticity ,, ,, ...	2,373,000
Rate of load in lb. per minute	963

Systematic.

A handsome tree, attaining a very large size, although the smaller forms are often reduced to a bushy scrub, quite glabrous, the buds and young leaves often very gummy. Leaves simple, shortly petiolate, oblong, very obtuse, entire, coriaceous, glabrous or whitish underneath, 1 to 2 inches long in the larger forms. Flowers white, very showy, the broad petals often 1 inch diameter. Peduncles much shorter than the leaves. Capsules usually about ½ inch long.

Geographical Range.

Found in the mountainous districts of Tasmania, especially the South and West Coasts, and the interior.

NATURAL ORDER.

Saxifrageæ.

THE representatives of this world-wide Order occur in almost every State of the Commonwealth, and range in size from a small herbaceous annual to a fair-sized brush tree. As a timber yielding family, it has little reputation outside Australia, but here it yields a few fine-coloured good hardwoods. The principal Australian timbers, however, are mostly of a soft nature, the exception being *Weinmannia lachnocarpa*, Mararie, and *Callicoma serratifolia*, Black Wattle.

SPECIES ILLUSTRATED IN COLOUR :—

Weinmannia lachnocarpa, F.v.M. (**Mararie**).

*Weinmannia lachnocarpa, F.v.M.

"MARARIE." Plate 30.

TIMBER.

DESCRIPTION AND USES.

This is one of the finest hardwoods in Australia, the colour being especially acceptable,—a pleasing pink. It is a very hard, close-grained timber, and has a thin bark, very little sapwood, and practically no figure. Apparently suitable for machinery bearings, heavy framing, coach and carriage building, certain parts of ship-building, house construction, bridge work, or for any purpose requiring a hard, strong timber. It has also been used for golf clubs, and has given great satisfaction.

H = Very hard. W. = 50 lb. per cubic foot.

ANATOMICAL FEATURES.

An exceptionally even-textured timber, the fibres being of a uniform diameter, with thick walls and a small lumen; the pores are rather small, with comparatively thick walls, and irregularly scattered amongst the other wood elements. The wood parenchyma is of very

small dimension, and occurs amongst the fibres. The rays are multiseriate mostly, the cells being filled, like most of the other parenchyma, with a reddish deposit. The vessels are narrow with well-marked wall perforations, but devoid of tyloses. The most characteristic feature of this timber is the number of crystal parenchyma or sacs, which are fairly numerous, these calcium oxalate crystals being well seen in sections cut in either of the three ways illustrated. A single crystal is restricted to each individual cell.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load, in lb.	7,790	7,540	8,345
Modulus of rupture in lb. per square inch...	15,580	14,685	14,502
,, elasticity ,, ,, ...	2,584,615	2,767,205	2,722,207
Rate of load in lb. per minute	556	580	642

Systematic.

A tall tree with spreading head, the trunk often straight, 2 feet diameter. The bark rough and scaly. Leaves trifoliate, the common petiole often very short. Stipules dimediate, lanceolate, 1½ line long. Leaflets nearly sessile, ovate lanceolate, remotely crenate or repand, serrulate, 2 to 6 inches long, 1 to 2 inches broad, thinly coriaceous, acuminate, shining on both sides, lateral nerves spreading, the veins and veinlets copiously reticulate. Racemes usually several on a very short peduncle or solitary, 2 to 3 inches long at the end of the branchlets. Pedicels short, articulate near the base, silky tomentose. Calyx deeply six, rarely five or seven-partite, persistent, lobes lanceolate or ovate-lanceolate. Petals none or very fugacious. Stamens usually about twenty. Filaments glabrous, linear-setaceous, about 2 lines long. Anthers minute, cordate-rotundate, dorsi-fixed, dehiscing. Styles two, rarely three, straight, subsulate, setaceous, about 1½ line long, glabrous, free. Stigmas very minute. Capsule ovate, about 2 lines long, almost all superior, densely woolly, with reddish-brown hairs.

Geographical Range.

New South Wales, Northern brush forests. Queensland, Southern localities, Upper Barron River.

PLATE 29.

MARARIE.

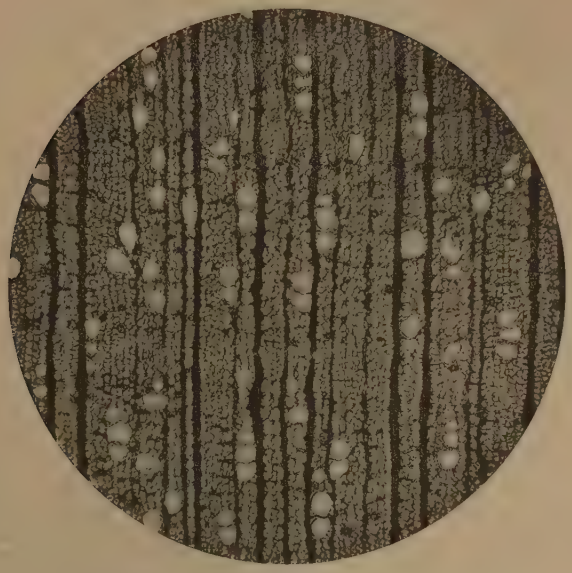
(*Weinmannia lachnocarpa*, F.v.M.)

PLATE 30.

BLACK WATTLE.

(*Callicoma serratifolia*, ANDR.)

FIG. XXXII.



CROSS SECTION, showing the small fibres; numerous dark rays; and small pores; portions of late and early growth are also seen.

Micro. photo.]

RADIAL SECTION, with portions of heterogeneous rays; masses of fibres, and crystal sacs—extreme left and right (small) and other places larger ones.

[*T. C. Roughley,*

TANGENTIAL SECTION, with rays filled with deposit; fibres, and many crystal wood parenchyma.

WEINMANNIA LACHNOCARPA, F.v.M.

NATURAL ORDER.

Combretaceæ.

A NATURAL Order distributed over the tropical regions of the new and old world, and some species yield excellent timber. Only four Genera are represented in Australia, and one of these, *Macropteranthes*, is endemic. They are not well known trees being restricted to the Northern portion of the Continent.

The Genus *Terminalia* contains the best timber yielding species which are—*T. platytera*, F.v.M.; *T. oblongata*, F.v.M.; *T. bursarina*, F.v.M.; *T. seriocarpa*, F.v.M.; *T. porphyrocarpa*, F.v.M.

With the exception of *T. bursarina*, which has a dark coloured timber, all the others are pale yellow or light coloured, close grained, hard, with a neat figure, making them all suitable for cabinet work and general economic purposes.

NATURAL ORDER.

Myrtaceæ.

An Order fairly well distributed over the world, more particularly in the tropics and warmer parts of the temperate zones, and strongly represented in the Australian Flora, especially in the Genus Eucalyptus. In the representatives of this Natural Order, Australia has, for variety of qualities and colour, probably the finest collection of hardwood timbers in the world, and their appreciation is shown by great afforestation enterprise in other parts of the world, for Eucalypts are being planted in enormous numbers in the Western States of North America, and South America. In Africa alone millions are placed under cultivation every year.

The other Genera are not so prolific in species, but, nevertheless yield some very fine hardwoods such as Syncarpia, Tristania, Melaleuca.

All are famous for their hardwoods which are used in almost every branch of Technology, the most recent use being decorative cabinet work, as shown by the illustrations here given.

The following are the principal Genera which produce hardwoods:—

LEPTOSPERMUM.

TIMBER.

Description and Uses.

These are shrubs or small trees, found mostly near the Coast, but the timber, although not of great size, is especially valued for tool handles, and small boat building. It varies very little in the different species, being light-coloured, tough, and close-grained. In texture they are not unlike English Box, but the annual rings are very much more pronounced, and in the case of *L. lanigerum*, these are wider than any other hardwood described in this book (Fig. XII). They are evidently quick growers in the young stage.

The following are the principal timber species:—

L. flavescens, Sm.; *L. abnorme*, F.v.M.; *L. myrtifolium*, Sieb.; *L. Wooroonooran*, Bail.; *L. lanigerum*, Sm.; *L. tævigatum*, F.v.M.

They are commonly known as "Tea Trees," incorrectly "Ti Trees," which is a New Zealand name. The origin of the word "tea" in this connection is that the early settlers thought Australia was a part of China, and being short of the real thing, used the leaves of these plants as a substitute.

CALLISTEMON.

TIMBER.

DESCRIPTION AND USES.

These are also known vernacularly as Tea Trees ; their timber, however, is not of large size or of so good a quality as the previous genus *Leptospermum*. They are pale brown in colour, hard, close-grained, and inclined to be interlocked and tough. The timber could be used for tool handles and other small commodities requiring strength.

The three principal species are :—

C. lanceolatus, DC. ; *C. salignus*, DC. ; and *C. viminalis*, Cheel. Mr. Cheel states : "The timber of this species is used for ship-building and wheelwrights' work."

MELALEUCA.

The species in this group of Myrtaceæ are mostly found in swamp lands around the Coast, and only occasionally on high ground.

The timbers are particularly appreciated for their durability in water, and this is well illustrated in the making of corduroy roads, no other being used when this can be obtained.

The wood is a very attractive one, and in texture much resembles Italian walnut, although lighter in colour.

The species have an extensive range around the Coastal Districts.

SPECIES ILLUSTRATED IN COLOUR :—

Melaleuca Maideni, R T.B. (Bellbowrie Tea Tree).

Melaleuca leucadendron, Linn.

"BROAD-LEAVED TEA TREE."

TIMBER.

DESCRIPTION AND USES.

In a paper (Proc. Linn. Soc., N.S.W., Vol. XXXVIII, p. 597) on the two following species, it is shown that no satisfactory proof has yet been produced to prove that this species occurs in Australia, but the name is given, as it is possible that it may yet be found in the north west of the Continent, in which case it must be added to the list of our hardwoods, as the Indian data place it with that class of timbers. Mr. Edwin Cheel, in the "Flora of the Northern Territory" (Ewart and Davies), Appendix 2, p. 292-3, states in his remarks on *M. leucadendron* :—" . . . . . I have accordingly drawn up a list of them (synonyms) in alphabetical order of those species which have to be taken into consideration when dealing with *M. leucadendron*." Then

PLATE 31.

TEA TREE.
(*Melaleuca Maideni*, R.T.B.)

PLATE 32.

SMOOTH-BARKED APPLE.
(*Angophora lanceolata*, CAV.)

follows a list in which is given *M. Maideni*, R.T.B. = *M. veridiflora*, Guertn; *M. Smithii*, R.T.B. = *M. leucadendron*, Linn., var. *albida*.

My paper (*loc. cit. supra*) was the result of a personal systematic investigation of the species in Australian and European herbaria, as well as after correspondence with these before coming to a decision, which latter, however, was not final till research had been undertaken by Henry G. Smith upon the chemistry of the species concerned. However, I have traversed my work again but found no additional data sufficient to cause me to alter my previous classification.

*Melaleuca Maideni. R.T.B.

"BELLBOWRIE TEA TREE." Plate 31.

TIMBER.

DESCRIPTION AND USES.

A pale, delicately-tinted, light brown wood, one of the finest timbers in the museum. It is hard, yet light in weight, dresses easily, polishes well, has a nice close grain, and even texture, whilst its colour gives it rank as an excellent cabinet timber, and so is one of the best all-round timbers of the Continent; obtainable in fair-sized logs, and could thus be used for bridge decking, boat knees, beams, piles, &c., as it is very durable in the ground and in water, for which it is especially recommended. Having no pronounced sapwood and being free from borers, it, therefore, cuts up with little waste. It is a splendid timber for gun stocks and carving, the texture giving a sharp arris.

H. = Moderate. W. = 43 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	6,040	5,830
Modulus of rupture in lb. per square inch ...	12,324	11,896
„ elasticity „ „ ...	.....	.....
Rate of load in lb. per minute...	464	833

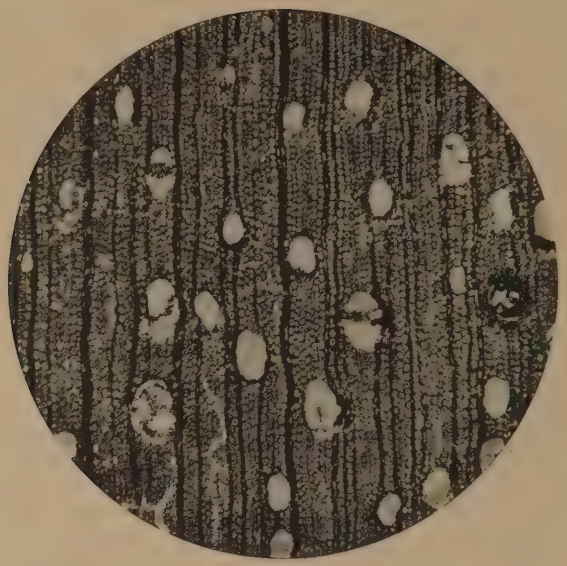
Systematic.

A tree often growing to a large size, with a pale-coloured laminated papery bark, with red streaks when cut on the quarter; branchlets angular, pubescent. Leaves erect, glabrous, ovate, sometimes oblique, obtuse, subcoriaceous; petioles short, silky pubescent, mostly five to seven or more nerved, rarely three-nerved, with anastomising veins, 4 to 5 inches long and ½ inch wide. Flower spikes terminal in all the specimens examined, or in the axils of the last two or three leaves, larger and longer than in *M. Smithii*. Rhachis and calyx pubescent. Calyx-tube short, cylindrical, about 1 inch long and 1 inch diameter, pubescent. Fruit comparatively large, squat, cup-shaped, 3 lines in diameter at base, mostly distant at the base of the outgrowing branchlet. This species differs from *M. Smithii* in having a superior timber, probably the best of the genus. Morphologically the species differs from *M. Leucadendron* in the shape, length, and texture of the leaves, in the inflorescence, and in chemical constituents.

Geographical Range.

Casino, Port Macquarie, and North along the Coast as far as Queensland.

FIG. XXXIII.



CROSS SECTION, showing regular rows of fibres between the rays (dark lines), and numerous pores.

Micro. photo.]

RADIAL SECTION, showing heterogeneous rays; portions of two vessels, and compact rows of fibres.

[*T. C. Roughley.*

TANGENTIAL SECTION, showing fibres and rays.

MELALEUCA SMITHII, R.T.B.

*Melaleuca Smithii, R.T.B.

"BROAD-LEAVED TEA TREE."

TIMBER.

Description and Uses.

A hard, close-grained, medium weight wood, having a light, pinkish colour inclining to red, with a large wavy figure; planes and works well, and takes a good polish. Could be used for general building purposes, but especially for posts, being, like its congeners, very durable in the ground. It is suitable for boat building, particularly "knees," and should also rank as a cabinet timber of some merit, its colour and texture adapting it for this branch of industry. It is an excellent wood for carving. (See under wood-carving, Part III.)

H. = Hard. W. = 47½ lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	5,040	4,790	4,830
Modulus of rupture in lb. per square inch ...	10,250	9,742	9,823
,, ,, elasticity ,, ,, ,, ...	1,464,400	1,109,400	1,262,400
Rate of load in lb. per minute	840	958	966

Anatomical Features.

A close, compact timber, the fibres with their thick walls forming by far the bulk of the wood elements; the lumen in transverse section appearing like a single line, or flattened canal with branches or arms; the perforations are small, ovate, and longitudinally placed. The pores are not so very numerous, the wood parenchyma being scattered, or collected around the vessels. The rays are numerous, with long, narrow secretion-filled cells, and bounded top and bottom with rows of broader cells, partaking almost of the character of tracheidal cells. They are both uniseriate and two or three cells wide; the vessels are plentiful and the cells formed by the partition walls small; tyloses were not seen in the specimens examined.

Systematic.

A tree often attaining large dimensions, with a thick bark, composed of thin papery layers. Leaves very numerous, glabrous, alternate, or verticilate at the ends of the branchlets, ovate or elliptical-ovate, rigid, straight, obtuse, subcoriaceous, on short petioles, mostly about 2 inches long and ½ inch wide, three to five nerved, but in general with three, with anastomising veins. The Gosford and Terrigal leaves are smaller, thinner, and narrower than the Sydney ones. Young terminal leaves silky-hairy. Flowers with cylindrical spikes, short, 1½ inch long, mostly not interrupted, axillary, or two or three terminal, rhachis glabrous or with a few rusty-coloured minute hairs. Calyx-tube about 1 line in diameter, or 1 line long. Petals obtuse, 2 lines long. Fruit sessile cylindrical, about 2 lines in diameter and 1½ deep; rim counter-sunk before opening, but thin when mature.

Geographical Range.

Rose Bay, Gosford, Bondi, and Terrigal, New South Wales.

Melaleuca linariifolia, Sm.

TIMBER.

DESCRIPTION AND USES.

A hard, close-grained timber of a dark brown colour. It has a good figure when cut with the ring, and should be very acceptable for marquetry, veneers, or for small articles in the cabinet trade.
H. = Hard. W. = 52½ lb. per cubic foot.

Systematic.

One of the tallest trees of the genus, with slender branches, the bark white, in papery layers, the young shoots and inflorescence usually pubescent, the adult foliage glabrous and often glaucus. Leaves mostly opposite, linear or linear-lanceolate, concave or keeled, rigid, acute, ¾ to 1½ inch long. Flowers white, fragrant, in distinct pairs, in rather dense spikes of 1 to 1½ inch, at first terminal or in the upper axils, the axis soon growing out into a leafy branch, the rhachis and calyxes more or less pubescent. Calyx-tube ovoid-globular, 1 to 1½ line long. Petals about twice as long as the calyx-lobes. Fruiting calyx not much enlarged.

Geographical Range.

Coast District of New South Wales to the Northern parts of Queensland.

Melaleuca symphyocarpa, F.v.M.

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey states concerning this timber that it is dark-coloured, close grained, hard, and prettily marked.

Systematic.

Glabrous and glaucous. Leaves alternate, oblong, obtuse, narrowed at the base, 1½ to 2½ inches long, mostly vertical, flat, rigid, many nerved. Flowers in dense globular lateral heads, sessile on the former year's branches. Calyx-tube campanulate, about 2 lines long. Petals rather above 1 line diameter. Fruiting-heads ½ inch diameter, the fruits closely appressed or connate, the calyx-tube circumsciss and deciduous, leaving the adnate part truncate on a level with the capsule.

Geographical Range.

The Islands of Torres Straits and the Gulf of Carpentaria.

*Melaleuca styphelioides, Sm.

"PRICKLY-LEAVED TEA TREE."

TIMBER.

DESCRIPTION AND USES.

This is one of the closest and straightest-grained timbers amongst our hardwoods, having a reddish brown colour, and a plain figure; dresses and polishes well. It could be used for coach and carriage construction, cabinet work, bridge work, gunstocks, or for building purposes, and like its congeners is reputed to be very durable in water.
H. = Very hard. W. = 67½ lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	7,430	8,590
Modulus of rupture in lb. per square inch ...	14,860	17,180
,, elasticity ,, ,, ...	1,800,000	2,086,900
Rate of load in lb. per minute	825	1,227

Systematic.

A tall tree, attaining sometimes 80 feet, the young shoots and inflorescence silky-pubescent or villous, otherwise glabrous. Leaves alternate, ovate or ovate-lanceolate, acuminate, pungent, pointed, mostly about ½ inch long, rigid, finely striate, with many nerves. Flowers in rather dense oblong or cylindrical spikes. Calyx-tube ovoid, about 1 line long. Petals as long as the calyx-lobes, but very deciduous. Fruiting spikes often leafy, the calyces crowned by the rigid erect lobes.

Geographical Range.

Coast Districts of New South Wales and Queensland.

Melaleuca Preissiana. Sch.

"TEA TREE."

TIMBER.

DESCRIPTION AND USES.

A pale coloured timber and when polished much resembles Satin wood in both figure and colour. It is a hard, close-grained, somewhat resembling *M. Maideni* in texture, and is suitable for boat building, posts, bridge work, cabinet work, veneers or marquetry, or for any purposes requiring a durable timber.

W. = 62 lb. per cubic foot.

Systematic.

A tall shrub or tree, the young shoots and often the inflorescence more or less pubescent or hirsute, becoming glabrous with age. Leaves scattered, rather crowded, erect, spreading or recovered, lanceolate or oblong linear, acute or obtuse, flat, thick and rigid, obscurely one or three nerved, rarely exceeding ½ inch in length. Flowers not large, white or yellowish, in loose oblong or cylindrical spikes, 1 to 2 inches long, rarely terminal: rhachis and calyxes glabrous or tomentose. Calyx-tube ovoid, thick, above 1 line long, lobes much shorter, ovate, often persistent. Petals about 1 line diameter or smaller.

Geographical Range.

Victoria, South Australia, and West Australia.

Besides those particularised above, there are several Melaleuca that attain tree size such as—

M. pauciflora, Turcz; *M. squarrosa*, Don.; *M. ericifolia*, Sm.; *M. genistifolia*, Sm., and others;

and these, judging from their congeners, very probably yield equally excellent timbers, but specimens were not available from which to give a description.

ANGOPHORA.

A genus endemic to the Eastern States of Australia. The species are quite limited, numbering less than a dozen, a few extending over a fair geographical range, such as *A. subvelutina* and *A. lanceolata*. As a class they are not famous for their timbers, yet one or two species yield splendid material, especially the latter.

Angophora subvelutina, F.v.M.

"ROUGH-BARK" OR "BROAD-LEAVED APPLE-TREE."

TIMBER.

DESCRIPTION AND USES.

This hardwood may be described as of rather a coarse nature when sawn and split, yet it planes to a fine smooth surface, being not unlike some Stringybarks in texture, and similar in colour. It has a medium open grain, also a short wavy figure which looks very pretty when polished. Sapwood readily attacked by borers. Suitable for indoor work such as panelling, cabinet or carriage work and building purposes.

H. = Moderate. W. = 48 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	4,150	4,860	4,980
Modulus of rupture in lb. per square inch ...	8,762	10,020	10,697
,, elasticity ,, ,, ...	1,464,000	1,504,600	1,842,600
Rate of load in lb. per minute	1,037	972	830

Systematic.

A tree attaining a considerable size *with a rough, persistent, deeply-furrowed bark*, but more so than in *A. intermedia*. Foliage and young shoots glaucous or minutely pubescent, with often a few bristles on the flowering brushes and inflorescence. Leaves sessile or nearly so, ovate or ovate-lanceolate, mostly acute, all (excepting rarely the upper ones) cordate at the base with rounded auricles as in *A. cordifolia*, 2 to 4 inches long, the veins numerous, but usually not so much so, nor so fine, as in *A. intermedia*. Flowers small, in long corymbs, precisely as in *A. intermedia*. Fruiting calyxes 3 to 4 lines diameter.

Geographical Range.

Perhaps the most widely distributed of the Genus extending over the Coastal and River Districts of Queensland and New South Wales.

*Angophora intermedia, DC.

"NARROW-LEAVED APPLE TREE."

TIMBER.

DESCRIPTION AND USES.

A timber rarely found on the market although the tree is quite common in the coast district. It would make splendid furniture, although at present it is only used for posts and rails. It is a pale coloured wood, generally free and easy to work, but occasionally interlocked. Has a very pretty, small, wavy figure, which should be very acceptable for dado framing and panelling; useful for cabinet work and for general application in the timber trades.

H. = Moderate. W. = 58 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	8,050	8,010	8,150
Modulus of rupture in lb. per square inch ...	17,524	16,020	16,520
,, elasticity ,, ,, ...	2,932,300	2,028,170	1,801,800
Rate of load in lb. per minute	805	801	815

Systematic.

A tree attaining a considerable size, with a *tough, persistent, fibrous bark*, quite glabrous or slightly pubescent, or rarely with a few bristles on the inflorescence. Leaves distinctly petiolate, lanceolate or sometimes ovate-lanceolate, acutely acuminate, 2 to 4 inches long, or even more in some specimens. Flowers rather small in loose corymbs or trichotomous panicles. Calyx usually about 2 lines long and 3 lines diameter at the top, but sometimes rather larger, the five ribs very prominent and the secondary ones also conspicuous; the teeth shortly subulate, rarely half as long as the tube. Fruiting calyx 3 to 4 lines diameter at the top and about as long.

Geographical Range.

The interior of Queensland, North Coast Districts and New England southern to Twofold Bay, in New South Wales, and in Victoria near the mouth of the Genoa River.

*Angophora lanceolata, Cav.

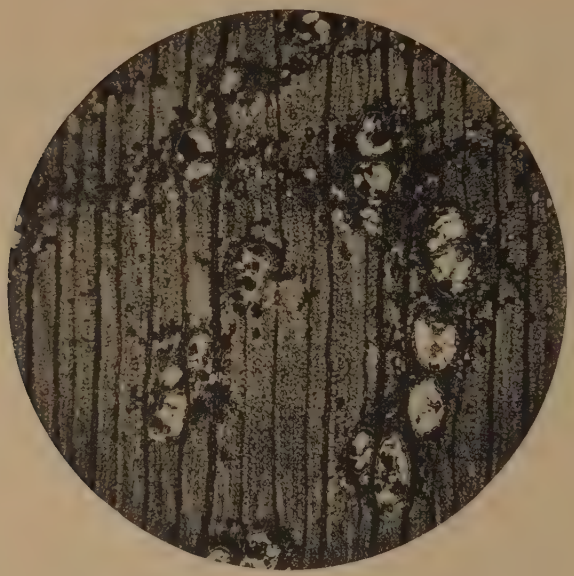
"SMOOTH-BARKED APPLE TREE." Plate 32.

TIMBER.

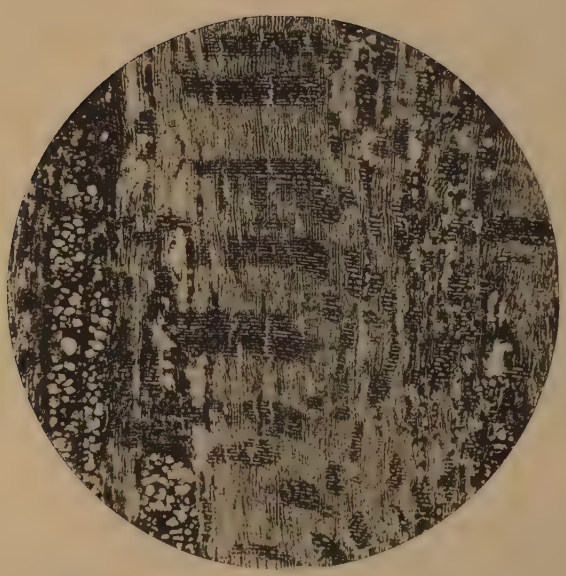
DESCRIPTION AND USES.

This is the *smooth-barked* Angophora which, with its clean stem and knolled branches is so conspicuous a tree in nearly all sandstone country of the two Eastern States (*infra.*). It is light-brown in colour, straight grained, free working, and sometimes known as "Red Gum." This name should be discarded, for it is not a Gum tree, a name reserved for some smooth-barked Eucalypts. The timber is reputed to be one of

FIG. XXXIV.

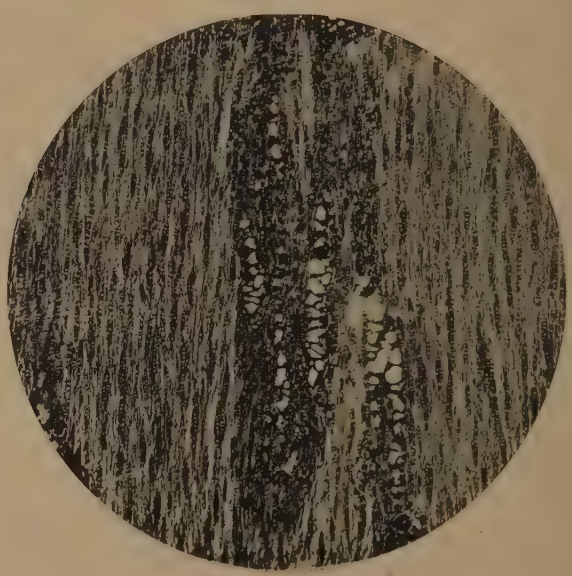


CROSS SECTION, showing small, compact radially arranged fibres. Wood parenchyma cells are clustered around the pores, and extend across the section at the top.



Micro photo.]

RADIAL SECTION, showing rays; and vessels on the left quite blocked with tyloses.



[*T. C. Roughley.*

TANGENTIAL SECTION, with vessels in the middle of picture quite closed with tyloses.

ANGOPHORA LANCEOLATA, CAV.

the hardest and best in the forests, and could be used for all heavy work requiring strength, even for such purposes to which Ironbarks are utilised. It is a timber that in the past has been much underrated for its commercial possibilities.

H. = Very hard. W. = 60 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	7,540	6,360	6,040
Modulus of rupture in lb. per square inch ...	15,283	13,290	12,080
,, elasticity ,, ,, ...	1,921,600	2,033,700	1,756,000
Rate of load in lb. per minute	942	978	862

Systematic.

A tree of considerable size, the bark deciduous in large smooth flakes; branches and foliage glabrous and scarcely glaucus, or rarely a few bristles on the inflorescence. Leaves distinctly petiolate, lanceolate, acuminate, mostly 3 to 5 inches long, coriaceous, with numerous fine parallel pinnate veins. Flowers in rather dense terminal corymbs or short panicles larger and more dense than in *A. intermedia*, rather smaller than in *A. cordifolia*. Calyx usuall y about3 lines long, and 4 lines broad at the top, the teeth very minute, or at any rate shorter and thicker than in *A. intermedia*, and the secondary ribs often very short or quite inconspicuous. Fruiting calyx usually thick and very smooth.

Geographical Range.

New South Wales, the Coast to the Blue Mountains, and District North of Bathurst. Queensland, Moreton Bay District and Burnett River.

Angophora Bakeri, E. Cuthbert Hall.

"SMALL-LEAVED APPLE TREE."

TIMBER.

DESCRIPTION AND USES.

A pale coloured timber of medium weight, with a pinkish duramen and pronounced alburnum—readily attacked by borers. Gum veins fairly prevalent. It dresses well, is open in the grain and fissile, and specimens free of gum veins and sapwood could be turned to some economic uses, such as various forms of cabinet and general carpentry work.

H. = Moderate. W. = 42 lb. per cubic foot.

Systematic.

Bentham (Flora Aust.) does not mention this form at all. It has usually been confused with *A. intermedia*, but any one seeing these two trees in the field could never confuse them, as *A. Bakeri* can be distinguished by its numerous narrow leaves which droop in characteristic fashion owing to the long petioles, and it forms a shorter, broader tree than *A. intermedia*.

It is a medium-sized tree, up to 50 feet high, with a diameter seldom exceeding 2 feet; bark fibrous, resembling that of *A. subvelutina*, F.v.M., and *A. intermedia*, DC; branchlets glabrous or with bristles. Leaves numerous, 1½ to 3 inches long, rarely more than ½ inch broad, narrow-lanceolate, petiolate, acuminate, falcate, opposite, when dry paler on the underside, glabrous. Flowers in dense terminal corymbs, or short panicles Calyx 2 to 3 lines diameter, turbinate, glabrous. Petals white, imbricate. Fruit slightly larger than that of *A. subvelutina*, 4 to 5 lines long, 3 to 4 lines broad, longitudinal ribs not prominent; rim thin, contracted, incurved, teeth very short, acuminate.

Geographical Range.

Coastal Districts of New South Wales; usually associated with *Eucalyptus haemastoma* and *E. corymbosa*.

Angophora melanoxylon, R.T.B.

"COOLABAH" OR "APPLE TREE."

TIMBER.

DESCRIPTION AND USES.

The timber of this species appears to be quite different in facies to that of the coastal species, inasmuch as it is very dark chocolate coloured, in fact, almost black, and not pale as in the case of most Angophora. It has a pretty wavy figure, is close grained, with a few gum veins, and in colour is almost identical with Italian or American walnut, and is thus particularly suitable for some forms of heavy cabinet work, such as billiard-table legs.

H. = Hard. W. = 54 lb. per cubic foot.

Systematic.

A medium-sized tree, from 40 to 50 feet high, with a diameter up to 3 feet; the bark somewhat similar to a "Box" bark, much less fibrous than that of *A. subvelutina*, F.v.M. or *A. intermedia*, DC.; branchlets glabrous or minutely pubescent, with or without bristles. Leaves much more numerous than in the other species of Angophora, mostly under 2 inches, rarely exceeding 2½ inches and under ⅛ inch broad; lanceolate or cordate at the base, with rounded auricles, sessile or almost so, nearly always opposite and decussate; blue-green on the upper side, pale yellow-green on the lower side, which is occasionally minutely pubescent. Flowers in dense terminal corymbs or short panicles, about the same size as, or perhaps a little less than those of *A. lanceolata*. Calyx 2 to 4 lines in diameter, turbinate, glabrous or with a few bristles. Petals white, imbricate. Fruiting calyx 4 to 6 lines long, often as broad at the top. Longitudinal ribs very prominent; rim thin, sometimes incurved.

Geographical Range.

The interior of New South Wales, Coolabah, Bourke, Angledool, West Bogan.

Angophora ochrophylla, R.T.B.

"APPLE TREE."

TIMBER.

DESCRIPTION AND USES.

The timber of this species is hard, open-grained, yet interlocked, of a light grey, pale chocolate, or fawn colour. No local use appears to be made of the wood, so that data are not available as to its adaptability or otherwise in technology.

Systematic.

A large spreading tree, with a rough "woolly" thick bark, glabrous in all its parts, with willowy filiform branchlets. Inflorescence in large, terminal, loose, delicate corymbs. Leaves opposite, on short slender petioles, lanceolate, slightly falcate, occasionally oblique, texture thin, almost membraneous, pale yellowish or ochreous in colour, 3 to 5 inches long. Flowers rather small, on exceedingly slender or almost filiform peduncles. Calyx 1 line long, teeth acuminate, ribs of equal prominence. Fruits on filiform pedicels up to 6 inches long, 3 to 4 inches wide, 2 to 3 inches diameter.

Geographical Range.

New South Wales (Bingara, Woodburn).

EUCALYPTUS TIMBERS.

HISTORICAL.

The first conception of the utility of our Eucalyptus timbers was not at all satisfactory or complimentary as shown by early records, for a certain Major of Engineers, writing home his impression of the newly-occupied country, gives an all-round disparagement of things in general, and particularises the timber resources of Australia as little above nil, for he states in this connection :—

> "Even the trees (Eucalyptus) are worthless, for not only after they fall, but even whilst standing, they are turned into sand."

Whilst we quite understand to-day the allusion (depredations of White Ants, —Termites), yet as regards our knowledge of the commercial nature of our timbers, *nous avons changé tout cela*, the verdict being that in the matter of hardwoods and decorative timbers, the Australian Eucalyptus holds a very front rank in the world's timber markets.

When the Colony was first founded freights were scarce, and evidence shows that Eucalyptus timber was one of the first raw products to be exported, to be later utilized in the Naval dock-yards of the old country for ship building. No greater recommendation could be given these woods for durability than the structures erected in those times, for they remain in some instances intact to-day, being as sound as when first placed in position.

The intrinsic value of these timbers has from time to time been brought under the notice of the outside world by the collections exhibited at the various Exhibitions held at different periods in London, 1851, 1862, and later at Paris and other International Exhibition centres.

CLASSIFICATION.

In classifying the timbers of the Eucalypts it would perhaps be well to first consider the Genus in groups, and for preference to arrange them according to the nature of their barks or cortically in their botanical sequence.

Although several systematic schemes have been suggested for the general classification of these trees, yet no single arrangement can be considered as satisfactory, and strongly marked lines of demarcation separating the groups one from another are not in evidence, the members of one group showing resemblance in certain directions to those of the others.

The trade difficulty, however, is to discriminate between the species composing these groups, for they are all classed as hardwoods, a term covering a multitude of timber characteristics, no regard being paid to such distinguishing features as colour

weight, durability, all being placed in one class simply because they possess this one characteristic in common, viz.,—hardness, the result being in many constructional works, buildings, and wood pavings a medley of timbers.

Few, if any, merchants or mills are prepared to sell a line of any particular species of timbers such as Mahogany, Blackbutt, or Stringybark. They will execute an order for "hardwood," and the purchaser has to make the selection from the consignment. A few, such as Spotted Gum, Tallow-wood, and Ironbarks, are, however, very often specified and can be obtained true to name, and a few others outside Eucalypts might be mentioned, *i.e.*, Teak, Turpentine, and Brush Box; the two former and the two latter, being difficult to separate, are often confounded in commerce.

This mixing of timbers is a great disadvantage in many industries; thus, in wood blocking as many as half a dozen species of timber will be used, each with its own special powers of atmospheric and attrition resistance, consequently, instead of having an evenness of surface during the life of the road, and which would obtain if all one kind of wood were used, the different breaking down of each kind produces an irregular surface for the traffic, and thus the disintegration of the best wood is considerably aided, and the life of the road seriously impaired or reduced.

This problem can only be overcome by stacking large quantities from which can be selected the quantity and kind required.

There is, perhaps, something to be said on behalf of the mill owner in this respect, for his action is really governed, to a certain extent, by nature, which in this Continent has not produced forests of specific trees, as found in the Northern Hemisphere, where one sees whole Beech, Oak, Elm, Pine, &c., forests, but here more often than not, species grow indiscriminately distributed throughout the forests, and the exceptions to this are very few.

In any classification of Australian timbers, Eucalyptus hardwoods are given pride of place, as they embrace by far the largest portion of our forests, but the quantity and value of our hardwood ornamental timbers, are by no means to be despised, and only recently has it been shown that quite a number of our Eucalyptus hardwoods fall in this category.

The scientific names of the Eucalypts here given are in accord with the scheme laid down by R. T. Baker and H. G. Smith in "Eucalypts and their Essential Oils," p. 3, which is as follow:—

"A more real or natural system of classification had to be adopted, viz., founding a species, not on morphological characters of dried material alone, but on—

(1) A perfect knowledge of the trees.

(2) The nature and character of their barks.

(3) The nature and character of their timbers.

(4) Morphology of their fruits, leaves, buds, &c.

(5) Chemical properties and physical characters of the oils, dyes, kinos, &c., and any other evidence, such as histology, physiology, &c., that will assist in establishing differences or affinities of species.

Our experience shows that a species so founded is practically constant in specific characters however great the range of distribution may be."

The first practical classification of our Eucalypts was cortical,—one that was introduced by the first settlers at Port Jackson, 1788, and founded on the appearance of the bark, and this grouping of these trees has lasted to this day. The earliest botanist soon recognised that the bushman could differentiate his trees in the field very much better than the systematist could in the herbarium, working on the morphology of his material.

Under this bark classification the principal commercial groups of Eucalypts are :—

1. Bloodwoods.
2. Mahoganies.
3. Boxes.
4. Tallow-woods.
5. Stringybarks.
6. Woollybutts.
7. Blackbutts.
8. Gums.
9. Peppermints.
10. Ashes.
11. Ironbarks.

DESCRIPTION OF BARKS.

(1) BLOODWOODS.—In this group of trees the bark is rough, rigid, reddish in colour, friable, and very short in the fibre, with medium furrows.

(2) MAHOGANIES.—These have a bark almost identical with that of the Stringybarks.

(3) Boxes.—This is a more compact, fibrous-ridged bark than any of the previous groups, a light grey in colour, and the lattice pattern much smaller than in the Stringybarks, the furrows less deep than in any other lattice pattern group.

(4) TALLOW-WOODS.—This bark is yellow ochre in colour, laminated and scarcely rigid or furrowed.

(5) STRINGYBARKS.—These are characterised by the long fibres which intertwine and cross lattice-like, forming ridges and depressions, and are reddish-brown or grey in colour.

(6) WOOLLYBUTTS.—This bark may be described as a coarser kind than, or variety of, the Box bark.

(7) BLACKBUTTS.—These have similar characters to the Stringybarks, only black at the surface, as though burnt, and not extending so far up the trunk or branches.

(8) GUMS.—The largest group of all, having a smooth, pinkish, yellowish tint or whitish bark.

(9) PEPPERMINTS.—These barks might be described as a fine lattice pattern, and rather closer in texture than that of the Stringybarks, but shorter in the fibre and the colour more bordering on that of the Boxes.

(10) ASHES.—Somewhat similar in character to the Blackbutts.

(11) IRONBARKS.—A hard, rugged, compact, broadly-latticed pattern, high-ridged bark, either black or grey on the outer surface, and always dark red inside.

In order to assist in the identification of these groups of Eucalypts, coloured photographs of type sample of barks are given, as well as coloured illustrations of the foliage, inflorescence and fruits of each.

NOMENCLATURE.

The vernacular naming of our Eucalyptus trees has, unfortunately, been one of the bugbears of the Australian timber trade since its inception.

The cause of most of the trouble is owing to the giving, in some cases, of English common names to trees having fancied or supposed resemblance to the home article, with very often the most ludicrous results; for instance, the name "Apple Tree" is being applied to some species of Eucalyptus trees which have absolutely nothing in common with its English namesake, and many such instances could be given. Again, the same common name is sometimes bestowed upon half a dozen different species.

There is, however, such a wealth of timber here that there are not enough common names of those so far used to go round to each species, but this difficulty could be overcome by employing the specific portion of the scientific name as a trade term. Objections would, of course, be raised that the trade could not use these names—a contention to be challenged, for it is only within the last few years that the essential oil trade of our Eucalypts (to take only one section of the Flora) has assumed some proportions,—yet only scientific names are used. (See also under general article on "Nomenclature," Part III.)

This subject of nomenclature is again mentioned here because it is of the very greatest importance in our timber export trade, and also because serious attention is being given to it by the respective State Forestry Departments who look to the co-operation of the timber trade to assist in the removal of so serious a handicap to their best interests.

Unfortunately, the early scientific nomenclature of the subject had not reached its present stage, so that the determinations are not always in accord with those founded upon a more specific designation of recent times, but they are the original attempts and of some value.

There can be no doubt that it would be greatly to the advantage of all concerned in the trade, as well as to the technologist and scientist, if common names were dropped altogether and scientific names only used,—such as is now being done in New Zealand, South Africa, South America, and other parts of the world, and Australia should indeed now follow in this matter, having lost the lead.

TIMBER.

In the timber section of the Technology of the genus we have the greatest economics of the species, and in these trees Australia has probably the most valuable hardwood asset in the world. Except for patches in the interior, representatives of the genus extend over the whole continent. The enormous commercial value of the timbers was early recognised, and timber then formed no inconsiderable part of return freight for ships to England. The principal characteristics of these woods are their hardness and general durability under varying conditions, and commercially they can be utilised for almost every branch of technology. They vary exceedingly in texture, from hard, dense, interlocked wood, to open-grained, medium in weight or even light, and very fissile; consequently their avenues of utilisation are almost unlimited, and they are found in almost every branch of the timber trades.

The timber qualities are so appreciated outside Australia that enormous areas in the Western States of America, South America, North and South Africa are now being given over to the cultivation of the Eucalyptus.

The genus itself, from a systematic point of view, is certainly not easy of classification, and the timbers are equally difficult of identification, and it is only by years of familiarity with the subject that a knowledge of these timbers can be mastered, and even this, of course, must be supported by a botanical and field acquaintance with the tree.

Of the described species at present known, 80 per cent. yield excellent marketable timber, the exceptions being the "Mallees" or shrubby forms, some of the "Peppermints," one or two "Woollybutts," and a few others. The pride of place for durability is occupied by the "Ironbarks," which yield the hardest and most durable timber of the whole genus, and are fairly quick growers as hardwoods go.

EUCALYPTUS SPECIES.

BLOODWOODS.

THESE timbers are easy of determination from their congeners, as they possess a very open, coarse grain, much impregnated with Kino, known in the trade as gum veins. The species are few, distributed in a curve extending from Western Australia north through Eastern Queensland, and pinching out to a narrow belt at the junction of New South Wales and Victoria. See paper by Author, A.A.A.S., Vol. XIV, pp. 296-7. They vary in colour from deep red, *E. corymbosa*, lighter red, *E. intermedia*, and pale, *E. calophylla*, to almost white in *E. eximia*. They have derived this common name from the prolific exudation of a red-coloured astringent, commercially known as Kino.

The Bloodwoods are placed first, because the results of the researches carried out at this Institution on the genus seem to point to these being the oldest of the group from an evolutionary point of view.

The following are the principal trees of the group.

SPECIES ILLUSTRATED IN COLOUR :—

E. calophylla, F.v.M. (Red Gum, W.A.).
E. corymbosa, Sm. (Bloodwood).
E. intermedia, R.T.B. (Pale Bloodwood).

Eucalyptus tessellaris, F.v.M.

"CARBEEN."

TIMBER.

DESCRIPTION AND USES.

The timber is of a dark brown colour, except near the bark, close grained, but the pale-coloured vessels against the dark fibres give the appearance of an open grain in a longitudinal cut. It is hard, tough, and durable, suitable for parts of house building, constructional works, and any work requiring strength, and very much resembles in figure, grain, and timber Black Bean, *Castanospermum australe*.

H. = Hard. W. = 45 lb. per cubic foot.

ANATOMICAL FEATURES.

Fibres and vessels are the characteristic features of this timber and these appear in a transverse section to be arranged in wavy radial lines. The vessels in the secondary wood are all plugged with tyloses. The annual rings are fine, and also run in wavy concentric circles, and by their numbers point to the tree as a slow grower. The rays are fine and very numerous, as also are the wood parenchyma fibres, all of which contain a deposit which gives the timber its colour.

Systematic.

A tall tree with a persistent tessellated bark on the lower trunk; branches smooth; leaves thin and narrow, lanceolate, with numerous fine parallel not prominent veins, the intramarginal vein close to the edge. Flowers very short, usually several together in lateral clusters or very short panicles, often so reduced as to appear like a single compact irregular umbel, each peduncle with three to six flowers on short slender pedicels; anther cells opening by longitudinal slits. Fruit cylindrical or urn-shaped, rim thick, the capsule sunk.

Geographical Range.

It is a species found in the Inland parts of Northern New South Wales, South Australia, Queensland, Western Australia.

*Eucalyptus calophylla, R.Br.

"RED GUM." Plate 33.

TIMBER.

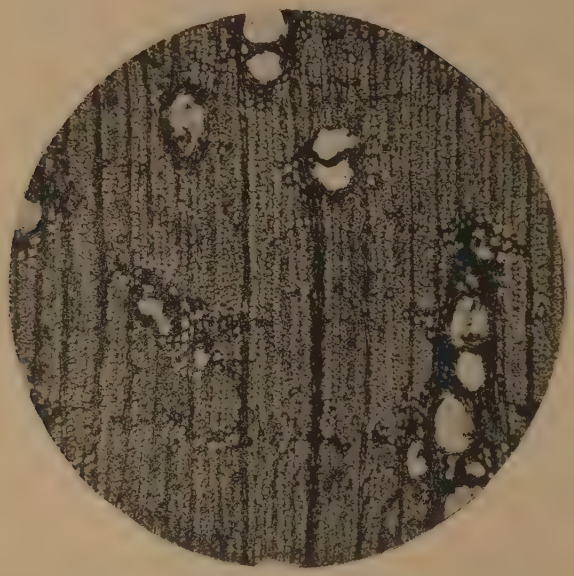
DESCRIPTION AND USES.

One of the commonest West Australian timbers, and generally found "growing amongst Jarrah, Wandoo, York Gum and Karri" (J. E. Brown). It is a very foliaceous tree, the leaves resembling in venation and shape those common to the group of Bloodwoods. The fruits are larger and urn-shaped, and similar to those of the previous species, but ribbed. It is a splendid tree for parks and streets. In grain and colour the timber is not unlike the Eastern Spotted Gum, *E. maculata*, but differs from it in the prevalence of numerous gum veins, which materially detract from its value as a marketable timber, but when it is obtained free from this defect, it would be very suitable for handles, spokes, shafts, or anything requiring toughness, elasticity and strength, with moderate weight. It is fissile, planes and dresses well, and altogether should rank as a good timber.

J. E. Brown in his "Forests of Western Australia," gives some splendid instances of its durability, both in the ground and water, and especially notes its immunity from the attacks of white ants.

H. = Hard. W. = 56 lb. per cubic foot.

FIG. XXXV.



CROSS SECTION, showing the regularity with which the fibres are arranged radially; and comparatively small pores with broken walls, and parenchyma clustered around them.

Micro. photo.]

RADIAL SECTION showing uniform rays in the lower half; portions of three vessels towards the left.

[*T. C. Roughley.*

TANGENTIAL SECTION, showing how the uniseriate rays predominate; in the lower left corner is the top portion of a vessel, and a few wood parenchyma cells.

EUCALYPTUS CORYMBOSA, SM.

PLATE 33.

RED GUM, W.A.
(Eucalyptus calophylla, R.BR.)

PLATE 34.

BLOODWOOD.
(Eucalyptus corymbosa, SM.)

PLATE 34A.

BLOODWOOD BARK.

(Eucalyptus corymbosa, SM.)

ANATOMICAL FEATURES.

The fibres are numerous and form close compact masses, especially in the winter growth of the wood. The pores are very numerous and longitudinally very distinct in a planed surface, but not of sufficiently large diameter to give the timber an open grained character.

Systematic.

A tall tree; leaves broad, or lanceolar-ovate, acute, almost equilateral, of firm and rather thick texture, dark-green above, much paler and not shining underneath; their veins subtle, closely parallel, very spreading, the marginal vein almost contiguous to the thickened margin of the leaf; flowers in umbels containing usually four to six flowers and forming terminal panicles, or some few axillary and solitary. Calyxes pear-shaped, not angular; operculum thin, patellar not so broad as the tube of the calyx and many times shorter. Fruits large, ovate urn-shaped, occasionally somewhat bell-shaped, three or four celled, not angular; rim narrow, valves almost deltoid, deeply enclosed; fertile seeds very large, black at the porsal edge, acute, not produced into membranous appendage; sterile seeds very much smaller, narrow.

Geographical Range.

Western Australia.

*Eucalyptus corymbosa, Sm.

"BLOODWOOD." Plate 34 and Bark 34A.

TIMBER.

DESCRIPTION AND USES.

This is the best known timber of the group, being often found on the market. The timber is hard, open in texture, of a dark red colour, with a cross grain figure, and almost invariably permeated with kino deposits in parenchyma sacs, and which form what are popularly known as "gum veins," and these, of course, detract considerably from its use in many avenues of trade, but this tannin substance evidently possesses the property of making the timber immune or proof against water, for it is very lasting in the ground, and is excellent for sleepers and posts, and should be suitable for telegraph poles, keels of vessels, wharf piles, &c.

H. = Hard. W. = 61 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	8,170	8,160	7,680
Modulus of rupture in lb. per square inch ...	17,369	16,993	16,159
,, elasticity ,, ,, ...	2,366,800	2,336,500	2,407,700
Rate of load in lb. per minute	1,021	1,020	1,280

ANATOMICAL FEATURES.

This wood has one of the coarsest of textures and a rather large percentage of vessels, which, with the kino sacs (gum veins) give the timber its open-grained character when viewed in a longitudinally planed surface. The rays are very numerous, and the fibres, like the wood parenchyma, have the cells filled with a red secretion from which it derives its common name.

Systematic.

A tree not easily confounded with other species. It grows very tall. Bark persistent, furrowed, of a reddish colour, friable nature, but not "stringy" in the sense of the "stringybarks," as it can be removed in flakes. The tree exudes kino very abundantly, the whole stem being sometimes covered with this reddish blood-like substance, and hence its vernacular name. Leaves lanceolate, slightly falcate, varying in size up to 9 inches long and 2 inches broad, pale on the underside; lateral veins very fine, and very numerous; only slightly oblique; intramarginal vein close to the edge. Peduncles numerous, mostly terminal, forming a large corymbose panicle. Buds nearly an inch long. Calyx conical, tapering into the pedicel. Operculum hemispherical, shortly acuminate. Fruit about 1 inch long, more or less urn-shaped; rim countersunk; valves sunk; pedicel about 1 inch long.

Geographical Range.

*Eucalyptus intermedia, R.T.B.

A "BLOODWOOD." Plate 35.

TIMBER.

DESCRIPTION AND USES.

The colour and texture of this wood differs from those of other Bloodwoods of the red varieties as it more closely approaches that of *E. tereticornis*, Sm., Forest Red Gum. The timber is hard, straight grained, and easy to work, much closer in texture than *E. corymbosa*, Sm., Sydney Bloodwood, and has quite a metallic ring when the fractured edges of two pieces are rubbed together. It is a very acceptable red hardwood for many purposes, and is quite suitable for cabinet work, rustic boards, house building, ornamental palings, and similar uses to those of *E. corymbosa*.

H. = Hard. W. = 63 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load	7,960	8,780	7,980
Modulus of rupture in lb. per square inch ...	16,080	18,287	16,506
,, elasticity ,, ,, ...	2,425,100	2,383,500	2,351,200
Rate of load in lb. per minute	995	1,097	1,140

PLATE 35.

PALE BLOODWOOD.
(*Eucalyptus intermedia*, R.T.B.)

PLATE 36

WHITE MAHOGANY.
(*Eucalyptus acmenioides*, SCHAU.)

ANATOMICAL FEATURES.

The fibres are close, compact, with a narrow lumen and pores numerous, which in a longitudinal surface show out well, but of not sufficient diameter to give the timber a coarse nature. Rays very fine and numerous and uniseriate.

Systematic.

It is a medium sized tree with a light brown fibrous bark, and lanceolate leaves about 6 inches long and 1 to 1¼ inch or more wide, pale on the underside; lateral veins oblique, fine, numerous, parallel, intramarginal veins quite close to the edge. Fruit urceolate, about 6 lines long, 4 to 5 lines in diameter, contracted at the orifice to sometimes 2 lines; rim thin. A tree closely allied to both *E. corymbosa*, Sm., and *E. eximia*, Schau. It has, however, always been considered as the northern form of the former species, but in botanical characters it more nearly resembles the latter, and especially *E. maculata*, Hook. The chemical constituents and optical features place it midway between the two former. It differs from *E. corymbosa* in the nature of the timber, bark, oil, and fruits which have not the marked recurved rim of that species. From *E. eximia* it differs in pedicellate fruits, a stringy, flaky bark, and its pinkish timber.

Geographical Range.

Ballina, Richmond and Clarence Rivers, Cambewarra, N.S.W.

Eucalyptus trachyphloia, F.v.M.

A "BLOODWOOD."

TIMBER.

DESCRIPTION AND USES.

The timber in colour and texture is not unlike that of *E. eximia*, F.v.M., being pale coloured, hard, and very durable. The heart-wood is fairly free from gum veins which are restricted mostly to the sap-wood. It is suitable for general hardwood purposes.

H. = Very hard. W. = 67 lb. per cubic foot.

ANATOMICAL FEATURES.

The fibres and vessels are the marked feature in a transverse section, the rays appearing in very fine lines, and are very numerous. The annual rings are marked by a preponderance of fibres.

Systematic.

A tall tree with a pale, yellowish, laminated, tessellated bark, quite unlike that of any other New South Wales species of Eucalpytus. The leaves are lanceolate, acuminate, occasionally falcate, from 4 to 6 inches long. Lateral veins fine, numerous, parallel, slightly more oblique than those of *E. corymbosa*, Sm., intramarginal vein quite close to the edge. The fruit similar in shape to that of *E. terminalis*, F.v.M., but smaller, urn-shaped, not constricted below the rim which is thin and countersunk, 3 inches long.

Geographical Range.

The species is to be found only in the Northern Districts, Narrabri, Murrumbo, New South Wales, and Queensland.

58699—K

Eucalyptus terminalis, F.v.M.

"PALE BLOODWOOD."

TIMBER.

DESCRIPTION AND USES.

Not being a large tree the timber is necessarily small, but very hard, close, wavy grained, strong, and dark red in colour. It is good for posts and fences, being durable in the ground, and general use on a homestead.

H. = Very hard. W. = 60 lb. per cubic foot.

ANATOMICAL FEATURES.

It is a fine close-grained timber, the fibres being compact, with a small lumen. The pores are very small and numerous, as also are the wood parenchyma, running parallel to the annular growth, but in undulating curves.

Systematic.

This Eucalyptus tree closely resembles *E. eximia*, Schau., and *E. intermedia*, R.T.B., in the shape of the fruits and nature of the timber and bark, but has paler and smaller leaves. The fruit is urceolate in shape. Mueller and Bentham were inclined to regard it as a variety of *E. corymbosa*, Sm., but it differs from that species in fruit, timber, and leaves.

It is a fair-sized tree, with a brick-red flaky bark, having lanceolate leaves mostly under 4 inches long, light yellow in colour, coriaceous; intramarginal vein close to the edge. Fruit urn-shaped, under 1 inch long and up to 8 lines diameter, contracted towards the countersunk rim; walls thin, not so woody as in other Bloodwoods.

Geographical Range.

It has an extensive Geographical range, being found in the Northern interior of New South Wales, West Australia, South Australia, and Queensland.

*Eucalyptus eximia, Sch.

"YELLOW BLOODWOOD."

TIMBER.

DESCRIPTION AND USES.

The wood of this tree is easily differentiated from that of its congeners, being white, or pale yellow in colour, and a shade darker heart-wood, and very much resembles that of *E. angophoroides* in nature and texture; gum veins rare, planes easily. It is suitable for carriage work, as a substitute for Spotted Gum, *E. maculata*, as it somewhat resembles that wood in facies; suitable for posts, household and general purposes, and even perhaps as a cabinet timber, as it looks well under a wax polish.

H. = Hard. W. = 52 lb. per cubic foot.

ANATOMICAL FEATURES.

It is a close timber, the fibres being in goodly proportion to the bulk of the timber substances and disposed in undulations. Vessels are fairly numerous and conspicuous in a longitudinally planed surface, giving the wood an open-grained appearance.

Systematic.

It is a good average forest tree, with a yellowish or lightish coloured flaky bark. Abnormal leaves are large, measuring sometimes up to 12 inches long and 2 inches broad, lanceolate falcate, on a petiole of about 12 lines long ; mature leaves smaller and more falcate, venations less distinct than in the younger leaves, lateral veins fine parallel, intramarginal vein close to the edge. Fruit urn-shaped, about 1 inch long, ¾ inch wide, contracted at the rim, which is thin : valves depressed. It is sometimes known as "white bloodwood," from the colour of its bark. In the shape of the fruits and colour of the timber it resembles *E. intermedia*, R.T.B.

Geographical Range.

It is quite a restricted species in geographical range, being only found on the Blue Mountains and Gosford, New South Wales.

Eucalyptus Abergiana, F.v.M.

A "QUEENSLAND BLOODWOOD."

TIMBER.

DESCRIPTION AND USES.

The timber of this rare species is similar in its nature to that of the typical Bloodwood, *E. corymbosa*, being hard, open grained, and of a red colour, and could no doubt be used for economic purposes similar to those enumerated under that species.

Systematic.

It is one of the tallest trees in its native habitat. The leaves are lanceolate and broad, with a close transverse venation and the fruits large, over 1¼ inch long and ¾ inch broad, urceolate, and much resembling those of *E. calophylla* and *E. corymbosa*, and occurring as it does at Rockingham Bay makes a connecting link between these Western and Eastern species of Bloodwoods, and thus this group of trees extends from the Victorian border north coastwards to West Australia.

Geographical Range.

Near Rockingham Bay, Queensland.

MAHOGANIES.

If these were classified on a cortical system some of them, no doubt, would be placed amongst the Stringybarks, especially *E. resinifera*, but the nature or colour, at least of the timber, was probably the determining factor in assigning it amongst Mahoganies, this being the chief resemblance to the typical Honduras Mahogany of commerce,—*Swietenia Mahogani*, which is a rather lighter wood, though, in weight. These hardwoods can be divided into two classes, (*a*) Pale and (*b*) Red.

Species Illustrated in Colour :—

E. acmenioides, Sch. (White Mahogany).
E. umbra, R.T.B. (A White Mahogany).
E. diversicolor, F.v.M. (Karri).
E. marginata, Sm. (Jarrah).
E. patentinervis, R.T.B. (A Mahogany).
E. longifolia, Lk. et Ott. (Woolly-butt).
E. resinifera, Sm. (Red Mahogany).

(*a*) PALE TIMBERS.

*Eucalyptus acmenioides, Sch.

"WHITE MAHOGANY." Plate 36.

TIMBER.

Description and Uses.

The common name has probably been given to differentiate the wood from that of *E. resinifera*, the red-timbered Forest Mahogany, but *E. acmenioides* has no resemblance to the Mahogany of Honduras.

The timber is pale-coloured, hard, close-grained and heavy, and is suitable for general building purposes, bridge work, ship building and wood blocks. It is extensively exported for sleepers, being one of the finest of our hardwoods.

H. = Hard. W. = 64 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load, in lb.	9,270	9,230	9,800
Modulus of rupture in lb. per square inch ...	18,540	19,093	19,998
,, elasticity ,, ,, ...	2,250,000	2,322,800	2,387,600
Rate of load in lb. per minute	927	923	980

ANATOMICAL FEATURES.

The fibres are of small diameter, numerous and indiscriminately scattered along with the vessels throughout the wood substance, consequently the annual rings are not well marked. The fibres have a tendency to run in cross curves, and so the timber is inclined to be interlocked.

Owing to the fineness of these wood elements, the texture of the wood may be described as close-grained. The ray parenchyma is fine, and has no secretionary substance in the cells.

Systematic.

This is a very distinct species, but care must be taken in the herbarium not to confuse it with *E. umbra*, R.T.B., as the early fruit of these species greatly resemble each other. This latter species differs from it in (1) young state leaves, (2) normal leaves being coarse and thick, and with a uniform greyish colour on both sides; the mature fruits always have a thick rim, and the timber and oils are also distinct from those of *E. acmenioides*. Both species preserve a constancy of specific characters throughout their geographical range.

It is a tall tree with a lightish coloured stringybark, having lanceolate leaves, thin, mostly 4 inches long by 1 inch wide, dark green on the upper surface, pale underneath, sometimes shining; venation distinct, in relief on the under surface of leaf, lateral veins oblique, parallel or spreading, intramarginal vein removed from the edges. Flowers in axillary peduncles. Calyx turbinate, about 2 lines in diameter. Operculum acuminate, shorter than the calyx. Fruit hemispherical, 3 lines in diameter, rim thin, capsule sunk, valves not exserted.

Geographical Range.

A tree with a fair Coastal range in New South Wales and Queensland.

*Eucalyptus umbra, R.T.B.

A "WHITE MAHOGANY." Plate 37.

TIMBER.

DESCRIPTION AND USES.

A very pale coloured, almost white timber, medium heavy, mostly with a straight grain, not interlocked, planes and works well. Seasons readily, but has a soft sapwood. It is not recommended for use in the ground, such as sleepers and wood blocks, as occasionally it is subject to the attacks of borers, but is, nevertheless, a useful wood for house building, bridge work, some forms of carriage construction, axe handles, spokes, and other hardwood purposes.

H. = Hard. W. = 62 lb. per cubic foot.

ANATOMICAL FEATURES.

Fibres particularly fine and numerous, with a very limited lumen; the pores are also very numerous and small, consequently in a longitudinal section are not conspicuous, and these give the timber along with the fibres a close-grained appearance; rings small and numerous.

Systematic.

A tall tree, attaining sometimes a height of 100 feet, with a dark-coloured stringybark. Abnormal leaves opposite, sessile cordate, ovate, acuminate, thin, pale-coloured on the underside; venation more pronounced on the underside, upper surface shining, over 3 inches broad and under 6 inches long. Normal leaves lanceolate, falcate, large, up to 9 inches long and 1¼ inch broad, pale-coloured on both sides, coriaceous; venation very distinct, lateral veins spreading, oblique, intramarginal vein removed from the edge. Flowers in short axillary peduncles. Calyx 1 line long. Operculum hemispherical, shortly acuminate. Fruit in the early stage pilular and under 3 lines in diameter, the rim thin and valves sunk, but in the mature stage hemispherical or inclined to be pear-shaped, with a diameter of 5 lines and with a thick red rim.

Geographical Range.

It appears to be restricted to the Coast Districts north of Sydney and Queensland.

(*b*) RED TIMBERS.

*Eucalyptus botryoides, Sm.

"BANGALAY."

TIMBER.

DESCRIPTION AND USES.

The timber is hard, close-grained, heavy, a bright red colour, and very durable, but not often found on the market. Sometimes very difficult to distinguish in colour from *E. saligna*, Sydney Blue Gum, or *E. robusta*, Swamp Mahogany, and perhaps is often sold on the market as such, but is heavier than the former.

It is suitable for all heavy constructional works, carriage and house building, sleepers, and frames for punts or lighters.

H. = Hard. W. = 66 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	8,290	9,670
Modulus of rupture in lb. per square inch ...	16,918	19,733
,, elasticity ,, ,, ...	2,318,800	2,403,600
Rate of load in lb. per minute	1,036	967

PLATE 37.

A WHITE MAHOGANY.
(*Eucalyptus umbra*, R.T.B.)

PLATE 38.

KARRI.
(*Eucalyptus diversicolor*, F.v.M.)

FIG. XXXVI

CROSS SECTION, showing regularity and uniform size of fibres, the black lines are the rays filled with a red substance; the large pores are surrounded by empty wood parenchyma.

Micro. photo.]

RADIAL SECTION, showing mostly uniform rays filled with a red deposit; and vertical fibres.

[*T. C. Roughley.*

TANGENTIAL SECTION, the numerous small rays filled with a red deposit.

EUCALYPTUS BOTRYOIDES, SM.

ANATOMICAL FEATURES.

This timber has a reputation for close texture, and this is fully borne out by an anatomical examination of its structure, which differs from that of, say, *E. marginata* and *E. resinifera* in that the fibres have thick walls and a very small lumen. They are very closely packed, and far outnumber the other wood elements.

The wood parenchyma fibres are clustered around the vessels and have no content, whilst the ray parenchyma has, but not of a solid nature, as generally obtains in a red wood, but taking more of a vesicular nature. The vessels are crowded with tyloses.

Systematic.

Although as a general rule this "Mahogany," or "Bangalay," occurs on the banks of creeks, when it is much gnarled, yet it is often to be seen growing on elevated ground and with a straight trunk of large dimensions. The bark is red-coloured, short fibred, flaky and brittle. Leaves lanceolate, broad, and about 6 inches long, shining on the upper side, drying a slate colour. Venation well marked, veins fine and numerous, the intramarginal one near the edge. Flowers in axillary clusters. Calyx angular, cylindrical. Operculum conicle, short. Fruit sessile, ovoid, oblong, rim narrow, capsule sunk, valves flat and not exserted.

Geographical Range.

It has a wide distribution on the Coast District of Victoria to Queensland.

*Eucalyptus diversicolor, F.v.M.

"KARRI." Plate 38.

TIMBER.

DESCRIPTION AND USES.

This is the giant tree of Western Australia, if not the whole of Australia. It attains enormous dimensions, and is a rapid grower (J. E. Brown).

The timber is red in colour, and has very much the appearance of Jarrah, indeed, the two are so alike that it requires expert knowledge to distinguish them. It is hard, heavy, elastic, and tough, does not dress well, nor can it be worked so easily as its congener.

It is said that for underground or waterworks the timber is certainly inferior to that of Jarrah, and this fact has been undoubtedly established.

However, as may be seen from comparative tests which have been made in regard to its tensile, crushing, and breaking strength, it is a timber of a very high order, and is suitable for superstructural works, bridge planking, shafts, spokes, felloes, flooring, general waggon work, beams, street blocking.

Where lateral strength is required, such as bridges, floors, rafters, beams of various kinds, it is to be preferred to Jarrah, and the reason for which is not difficult to seek in view of the interlocked nature of its fibres, which character is fully shown in the plate of a split piece (Fig. III). It is apparently one of the most interlocked of all Australian timbers.

H. = Hard. W. = 58 lb. per cubic foot.

ANATOMICAL FEATURES.

Anatomically its chief feature is the irregular crossing of the fibres which produces its great interlocking character, and they are more closely packed at the winter growth, thus making the annular rings fairly well marked. The vessels are comparatively larger than its congener, and consequently the grain is more open.

Systematic.

A tree attaining 80 to 100 feet, the trunk decorticating by hard layers of ¼ inch to ⅜ inch thick, the limbs and branches by chartaceous laminæ (Oldfield). Leaves ovate-lanceolate or lanceolate, acuminate, often falcate, 3 to 6 inches long, rather thick, with numerous fine, very diverging veins, often scarcely conspicuous, the intramarginal one at some distance from the edge, dark above, pale underneath when fresh (Oldfield). Flowers in axillary peduncles, lateral, terete or scarcely angular, each with three to six rather large flowers, not seen, however, fully expanded. Fruit ovoide-truncate, about ½ inch long, 4 to 5 lines diameter, contracted at the orifice, or almost urceolate, the rim rather thick, the capsule deeply sunk with a conical top, yet the valves much shorter than the border of the fruit.

Geographical Range.

A strictly Western Australian species, restricted to the south-west portion of that State.

*Eucalyptus robusta, Sm.

"SWAMP MAHOGANY."

TIMBER.

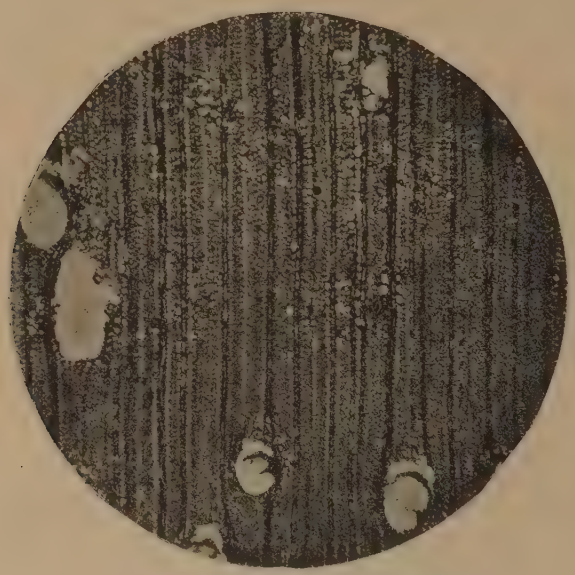
DESCRIPTION AND USES.

A hard, red, fairly open-grained timber, which is mostly paler in colour than *E. resinifera* and straighter in the grain, and is not subject to borers. If obtained with the bark on it would never be mistaken for *E. resinifera*, as the bark of *E. robusta* is friable, short in the fibre, and soft, whilst that of *E. resinifera* is stringy.

Owing to growing mostly on river flats and swampy ground, it carries a large percentage of moisture, and thus needs careful seasoning. It works well and takes a good polish. When thoroughly dry it is a good all-round timber for general building purposes, heavy cabinet work, coach and carriage building, wood blocks, wharf and bridge superstructures, and ship building.

H. = Hard. W. = 57 lb. per cubic foot.

FIG. XXXVII.



CROSS SECTION, showing late and early growth (bottom and top respectively); the fibres are in regular radial rows.

[*Micro. photo.*

RADIAL SECTION, showing how the ray cells are filled with a red deposit; and the vessels plugged with tyloses.

[*T. C. Roughley.*

TANGENTIAL SECTION, showing the small and numerous rays, almost equalling the quantity of fibres.

EUCALYPTUS ROBUSTA, SM.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	7,180	8,360	6,760
Modulus of rupture in lb. per square inch ...	14,360	17,294	13,520
,, elasticity ,, ,, ...	1,945,940	2,361,100	1,945,940
Rate of load in lb. per minute	718	836	1,126

ANATOMICAL FEATURES.

The wood elements have features by which alone it is almost possible to specifically determine the timber. The fibres are numerous, close packed, and medium thick walled, and comparatively large lumen, without any content; they are arranged radially in rows, and the perforations are not well defined. A few tracheids of an unusual length of cell were detected around the vessels, which are numerous, but all clogged with tyloses, whilst the wood and ray parenchyma are each filled with a red content of a solid vesicular nature; the wood parenchyma is very numerous, scattered throughout the other elements, as well as clustered around the pores. The rays are very numerous, and rather taller than in most species, and have remarkably straight, thin, or fine horizontal walls.

Systematic.

A tree identified by its fairly large fruits, and by its coarse leaves, and habitat, being rarely, if ever, found growing away from low, swampy land. It is fairly large, with reddish, brittle bark, between a "Stringybark" and a "Bloodwood" bark. Leaves large and coarse, leathery veins, numerous straight and parallel, prominent intermarginal vein close to the edge. Flowers large, in axillary peduncles. Calyx turbinate. Operculum cream-coloured, rostrate, and slightly larger and broader than the calyx tube. Friut urceolate, 9 lines long (including the pedical), rim bevelled, valves well sunk and rarely exserted.

Geographical Range.

The Eastern Coast Districts of the Continent.

*Eucalyptus marginata. Sm.

"JARRAH." Plates 39 and 40.

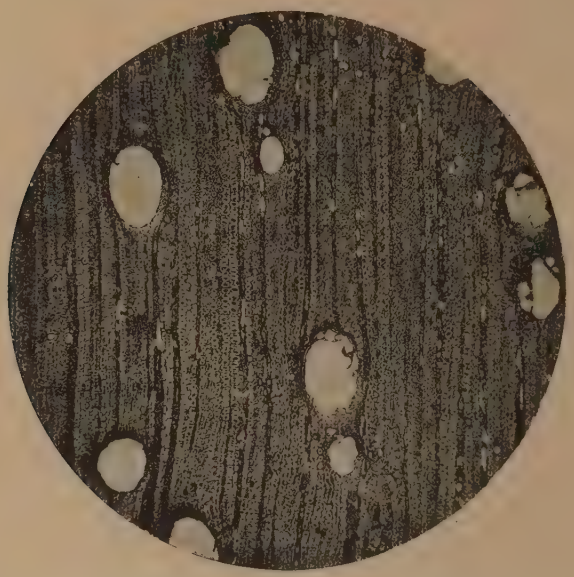
TIMBER.

DESCRIPTION AND USES.

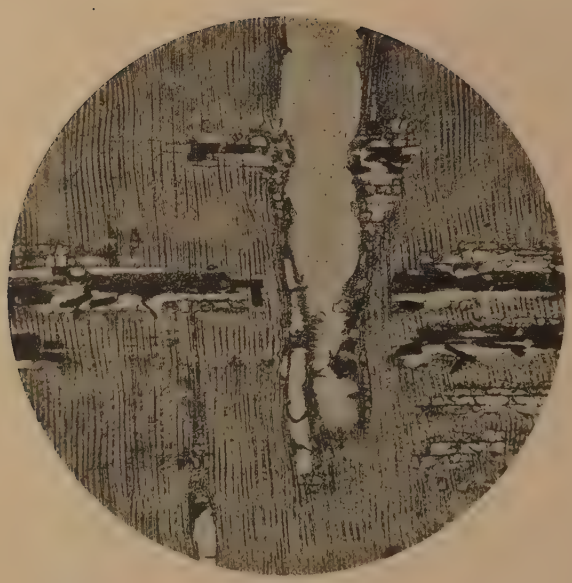
This is one of the finest hardwoods of Australia, and finds great acceptance in almost all branches of technology, for there is scarcely a trade in which this timber cannot be used.

It is red-coloured, of medium hardness, straight in the grain, fissile, and owing to its durable nature for outdoor work, is used for bridge decking, wood blocking, piles (being reputed to stand well in the

FIG. XXXVIII.



CROSS SECTION, showing a few large pores; numerous rays and radially arranged fibres with a red deposit in the lumen.



Micro. photo.]

RADIAL SECTION cut through portion of large vessel; the central cells of the rays are filled with a deposit, several cell contents having been moved in cutting. The lines amongst the fibres are the red deposit in the lumen.

[*T. C. Roughley.*

TANGENTIAL SECTION.

EUCALYPTUS MARGINATA, SM.

PLATE 39.

JARRAH.

(*Eucalyptus marginata*, SM.)

PLATE 40.

JARRAH.

(POLISHED.)

(*Eucalyptus marginata*, SM.

ground and water), carriage and waggon work, house construction, decorative fences, rustic boards, railway sleepers, telegraph poles; said to be immune from white ants; and to be distinguished from Karri by its straight grain and burning.

One might at first think that this Eucalyptus could harldy be classed as a cabinet timber, yet some excellent specimens of the tradesman's art made from it are to be seen in Australia, in commercial and private houses, this species being particularly suitable for this technical application. A very fine Jarrah suite of furniture is on view at the Imperial Institute in London. It is certainly heavy, but not more so than English Oak. The colour is a rich red, and this is one of, and, perhaps, its greatest recommendation in this direction. For office fittings it looks particularly rich, and is preferred by many to Mahogany or Cedar. It is very suitable for billiard tables, wainscotting, baluster rails, railway carriage decoration, dining-room or library furniture, or for shop and office fittings, being now extensively used for these purposes. One of the best hardwoods for carving. (See under Carving, Part III.)

H. = Moderate. W. = 51 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	5,850	5,720	7,140
Modulus of rupture in lb. per square inch ...	8,796	11,440	14,280
,, elasticity ,, ,, ...	1,080,000	2,666,660	2,240,000
Rate of load in lb. per minute	731	817	892

ANATOMICAL FEATURES.

The fibres compose the bulk of the wood elements, and run in radial rows with varying diameters. The walls are of medium thickness, with a rather comparatively large lumen filled with a red material which shows more clearly in a radial section—the walls of the fibres alternate with the lumen and its contents, which is not a solid mass as obtains in the ray cells, but is divided by partitions just as a vessel is divided by the tyloses. The perforations are few, ovate, occurring along the long axis of the fibre. The pores are fairly common, but the wood parenchyma is quite limited in amount, and scattered irregularly throughout the wood substance. The vessels are comparatively free from tyloses. The ray cells in almost every instance appear to be wholly filled with a secretion similar to that which narrows right into the extremities of the fibres, and in section cutting this substance is found running out into a thread-like line, either straight or wrinkled.

Systematic.

This is undoubtedly the principal tree of Western Australia. It is predominant above all others in its extent of forests, and in general appearance the Jarrah resembles, in bark only, what is known in the other States as Stringybark, which, of course, will at once explain the nature of the bark. The leaves are lanceolate, falcate, pale underneath, lateral veins strongly developed, oblique, spreading, intramarginal veins removed from the edge. Fruits globular, ovate, truncate, rim counter sunk, valves not exserted about 1 inch long and 6 inches diameter.

Geographical Range.

It is restricted in geographical distribution to the South Western area of Western Australia.

Eucalyptus patentinervis, R.T.B.

A "MAHOGANY." Plate 41.

(Prob. Syn. with *E. Kirtoni*. *Nom. nud.* See Author's remarks, *infra*.)

TIMBER.

Description and Uses.

This is a tree of some forest and commercial importance, as it possesses an excellent red timber, much resembling *E. tereticornis* and *E. rostrata*, but closer grained, and heavier than these two.

It could be used for house building, coach and carriage work, rustic weatherboards, wood blocks, heavy cabinet work, and certain parts of ship building. It works up and planes well, and takes a good polish.

H. = Hard. W. = 66 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

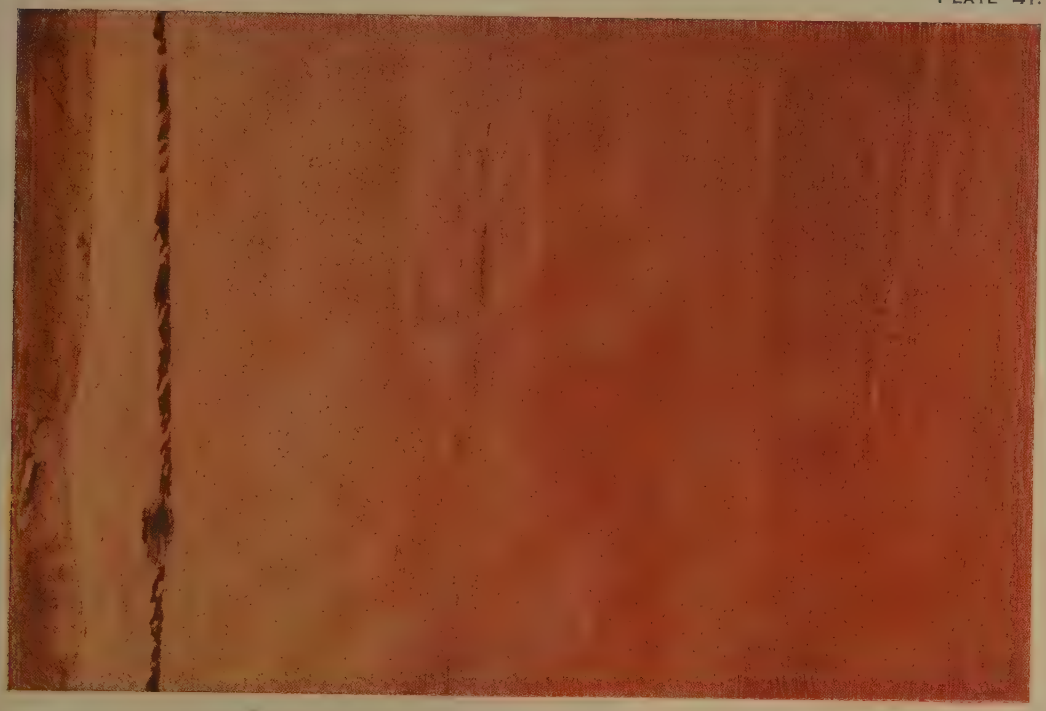
(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	7,000	6,590	6,710
Modulus of rupture in lb. per square inch ...	14,583	14,280	13,979
,, elasticity ,, ,, ...	2,025,000	2,082,700	1,87[illegible],400
Rate of load in lb. per minute	1,000	1,098	1,118

Anatomical Features.

It is a close-grained timber, the fibres being thick-walled with narrow lumen, compact and mostly disposed in a longitudinal plane, thus making it straight-grained. The pores are very numerous and small, scattered throughout the wood substance, and so the annular rings are not well marked. It is thus a close, compact timber, the vessels and fibres being in equal proportion, and the fineness of the vessels is well seen in a longitudinally planed surface. The rays are very fine and numerous.

PLATE 41.



A MAHOGANY.

(*Eucalyptus patentinervis*, R.T.B.)

PLATE 42.

WOOLLYBUTT.

(*Eucalyptus longifolia*, LINK & OTTO.)

Systematic.

A good-sized tree, as far as seen, with a bark similar to that of some species of pines. Ultimate branchlets angular. Abnormal leaves ovate, shortly acuminate, lanceolate, thin, almost membraneous, petiole slender, from 1 to 2 inches long; venation prominent, intramarginal vein removed from the edge. Normal leaves lanceolate, falcate, coriaceous, acuminate, almost a foot long in some cases; venation very distinct in the Coast trees, but finer in the inland ones. Lateral veins very prominent spreading, curved, numerous, the intramarginal vein removed from the edge. Fruit large, hemispherical to pyriform on a pedical of about 4 lines, 5 lines in diameter, rim quite 1 line broad, valves prominently exserted, acute, nearly 3 lines long.

The common name of "Mahogany" might lead one to place this species under *E. resinifera*, Sm., and, no doubt, it may have been so classed in herbaria, but it differs from it in the several features enumerated in *Proceedings Linn. Soc., N.S.W.*, 1890.

It was found after this species had been described that there was a specimen in the National herbarium, Melbourne, very closely resembling the material of this species, and labelled by Baron von Mueller *E. Kirtoni*. As no systematic description of *E. Kirtoni* was published by Mueller, the name *E. patentinervis* is retained for it by priority of publication.

Geographical Range.

Coast Districts of New South Wales.

Eucalyptus hemilampra, F.v.M.

"MAHOGANY."

TIMBER.

Description and Uses.

The timber is hard and heavy, and in colour rather lighter than the type *E. resinifera*, but is not affected with borers as obtains in that timber.

It could be used for constructional work, as the grain is not short, and also for minor branches of trade. It should be an acceptable timber for rustic weatherboards, wood blocking, coach and carriage work, ship building, &c. It planes and dresses well, and is suitable for cabinet work.

H. = Hard. W. = 66 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timbers of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	8,030	7,130	8,940
Modulus of rupture in lb. per square inch ...	16,611	14,600	17,880
,, elasticity ,, ,, ...	2,442,200	2,165,700	2,250,000
Rate of load in lb. per minute	1,147	1,188	1,117

Anatomical Features.

The fibres predominate over the pores, and thus it is a heavy timber. The latter are evenly scattered throughout the wood.

Systematic.

This tree was placed by Bentham (*loc. cit.*) as a variety of *E. resinifera* of Smith, and although the veration and shape of the leaves of the two trees resemble each other, the fruits and timber are distinct and quite constant, and it is on these constant specific characters that the species is here separated from *E. resinifera*, Sm.

A very tall tree, with a red stringy bark. Normal leaves of the same shape as the abnormal ones. Leaves broadly lanceolate, 6 to 9 inches long, shining above, paler underneath, of a thick texture; venation indistinct, lateral veins numerous, inclining to transverse, more prominent on the under side of leaf, intramarginal vein close to the edge; petiole 2 inches long, channelled above. Flowers in axillary peduncles, flattened, about 1 inch long. Calyx pyriform. Operculum rather longer than the calyx, hemispherical, either short, acuminate, or rostrate. Fruit hemispherical, angular at the base, up to 6 lines in length, rim flat, 1½ line broad, valves prominently exserted.

Geographical Range.

Rather limited in distribution, being only found at a few localities in New South Wales.

Eucalyptus pellita, F.v.M.

TIMBER.

Description and Uses.

A fine forest tree, yielding a wood of a light red colour and difficult to distinguish from *E. resinifera*, Forest Mahogany, both in weight and texture. It should be suitable for all kinds of constructional work, such as house building, bridge work, waggon building, and in some cases decorative purposes.

H. = Hard. W. = 62 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timbers of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	5,180	3,800
Modulus of rupture in lb. per square inch ...	11,512	8,741
,, elasticity ,, ,, ...	1,493,700	1,362,100
Rate of load in lb. per minute	575	633

Systematic.

A tree of 40 to 50 feet high, with a rough, dark grey bark (Dallachy). Leaves ovate-lanceolate or almost ovate, acuminate, nearly straight, 5 to 6 inches long or more, rigid, with numerous parallel, almost transverse veins, the intramarginal one near the edge. Peduncles axillary, or lateral, stout and much flattened, often 1 inch long, each with about 4 to 8 rather large flowers on thick angular pedicels, often as long as the calyx tube. Calyx-tube much broader and shorter than in *E. botryoides*, 5 to nearly 6 lines diameter, and more or less angular. Operculum thick, hemispherical, broader than the calyx-tube, with a short obtuse beak. Fruit subglobose-truncate or nearly hemispherical, 6 to 8 lines diameter, not contracted at the orifice, the rim raised above the calyx border, slightly convex and rather broad, the capsule scarcely sunk, the valves much projecting.

Geographical Range.

Coastal Districts of Queensland.

*Eucalyptus longifolia, Lk. et Ott.

"WOOLLY-BUTT" OR "PEPPERMINT." Plate 42.

TIMBER.

DESCRIPTION AND USES.

The timber is reddish in colour, hard, interlocked, and very durable, and suitable for all kinds of constructional work, carriage building, and all purposes requiring strength and hardness, such as sleepers, &c. It would make good newel posts and heavy table legs, and other heavy cabinet work. It is a superior timber to *E. resinifera*, Red Mahogany, lasting much longer in the ground, and is not liable to the attacks of the small borer as obtains in that species.

H. = Hard. W. = 68 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timbers of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	4,420	7,400	5,000
Modulus of rupture in lb. per square inch ...	9,142	15,416	10,638
,, elasticity ,, ,, ...	1,666,100	2,013,200	2,051,500
Rate of load in lb. per minute	1,105	1,057	1,000

Systematic.

A fine forest tree, with a rough, fibrous, persistent, or partially deciduous bark. Leaves lanceolate, usually long and falcate, often exceeding 6 inches, the veins fine and divergent, but rather distant, the intramarginal one not far from the edge. Peduncles axillary or lateral, usually recurved with three or very rarely four rather large pedicellate flowers. Calyx-tube turbinate, thick, and hard, sometimes slightly angular, 4 to 5 lines long, and as much in diameter. Operculum thick and hard, conical, about as long as the calyx-tube or sometimes longer. Fruit somewhat pear-shaped, truncate, nearly ¾ inch long, straight or scarcely contracted at the orifice, the broad rim prominent, bevelled, the capsule slightly sunk, but the valves sometimes protruding, or the whole fruit is shorter with a flat rim.

Geographical Range.

Coastal Districts of New South Wales, and Gippsland District of Victoria.

*Eucalyptus resinifera, Sm.

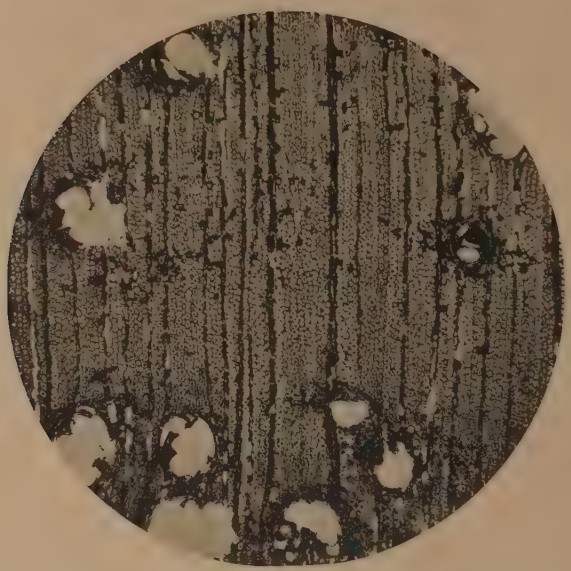
"RED MAHOGANY." Plates 43, 44, and Bark Plate 44A.

TIMBER.

DESCRIPTION AND USES.

This was one of the first timbers to be exported from Australia, and has been from the foundation of the Colony to the present time largely employed in the building trade, in which connection care, however, must be taken to prevent borer-affected samples being utilised. It will not last in damp, unventilated situations, and so is condemned for flooring joists, otherwise it is a good average house timber. It

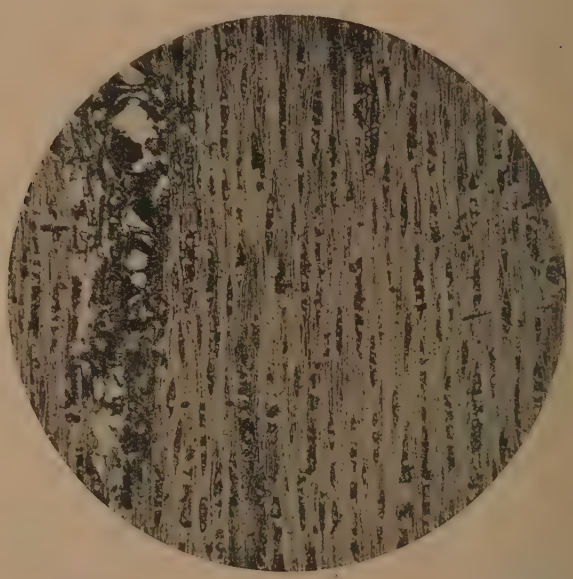
FIG. XXXIX.



CROSS SECTION showing fibres arranged in radial rows; fairly large pores, rays in black lines due to the presence of a red deposit, also occurring in the parenchyma (black spots) scattered amongst the fibres.

Micro. photo.]

RADIAL SECTION, showing clearly how the ray cells are filled with a red deposit, which in a few cases have become detached from the cells, and look like bricks removed from a wall.



[*T. C. Roughley*

TANGENTIAL SECTION with large vessel on the left plugged with tyloses.

EUCALYPTUS RESINIFERA, SM.

PLATE 43.

RED MAHOGANY.
(*Eucalyptus resinifera*, SM.)

PLATE 44.

RED MAHOGANY.
FIGURED
(*Eucalyptus resinifera*, SM.)

PLATE 44A.

FOREST MAHOGANY BARK.

(*Eucalyptus resinifera*, SM.)

is also used for frames for punts and lighters. It looks well as rustic boards and fences when oiled or varnished. Only rarely now is this timber found in cabinet work, and it requires careful selection before use, being subject to borers, which, of course, detracts considerably from its value. If obtained free of these, it looks very well when worked up into various articles of cabinet work, especially if the choice rests with a red coloured timber. It is hard, heavy, close-grained, dark-red in colour, dresses well and takes a good polish, and is in many respects very similar to Jarrah.

H. = Hard. W. = 61 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timbers of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	10,540	10,760	10,070
Modulus of rupture in lb. per square inch ...	21,437	22,416	20,691
„ elasticity „ „ ...	2,614,600	2,618,500	2,500,000
Rate of load in lb. per minute	1,054	1,076	1,118

ANATOMICAL FEATURES.

The fibres and pores are the salient feature of this timber and this is more particularly seen in a transverse section. The former are very thick walled, with lumen of varying diameters, which in almost every case has a red secretionary deposit which also characterises all the other wood elements not excepting the vessels; the pits of the fibres are very small, ovate, and in some instances bordered. The pores are very numerous, but thickest in the spring growth, and the fibres more numerous in the autumn growth. In a radial section the secretion is a very marked feature, and in the case of the fibres, it is seen to run right to the end of the tapering lumen, and when removed in the section cutting, appears like a corkscrew with a long, fine, needle point. The rays are very fine and numerous and uniseriate, only a few cells in height. The perforations of the vessel walls are small horizontal slits.

Systematic.

One of the largest forest trees of the State. The common name has been given to it in allusion to the timber resembling somewhat Honduras Mahogany. On a cortical classification it would be placed in the "Stringybarks," as its bark is more "stringy" than many Eucalypts known by that name. The fruits are characteristic, the hemispherical shape and flat rim being constant.

Leaves lanceolate, rather large and broad, thick, drying a light green colour on both sides: venation faint, the lateral veins almost transverse and parallel, the intramarginal vein close to the edge. Umbels axillary. Stalk compressed, number of flowers varying up to twelve in an umbel. Buds pedicellate. Calyx hemispherical. Operculum conical (sometimes several lines long), or hemispherical and acuminate. Fruit hemispherical, usually 3 lines in diameter, rim thick, capsule sunk, valves acuminate, well exserted.

Geographical Range.

Coastal Districts, New South Wales to Queensland.

BOXES.

A FAIRLY large variety of timbers is to be found under this class, the colour being, perhaps, more variable than obtaining under any other group. The wood is characteristic, being very hard and heavy, close grained, and very often having interlocked fibres. It brings the highest price in the market as a firewood, but is a timber worthy of a higher place in commerce than that. The following are the principal kinds, and although seldom found in the big markets of Australia, yet the timber is highly valued and much used in local centres.

They are here divided into two classes, according to the colour of the wood—Pale and Red.

SPECIES ILLUSTRATED IN COLOUR :—

E. angophoroides, R.T.B. (Apple-top Box).
E. Fletcheri, R.T.B. (River Box).
E. gomphocephala, DC. (Tuart).
E. hemiphloia, F.v.M. (Grey Box).
E. melliodora, A. Cunn. (Yellow Box).
E. polyanthema, Schau. (Red Box).
E. Rudderi, J.H.M. (Coast Red Box).
E. Woollsiana, R.T.B. (Narrow Leaf Box).

(*a*) PALE TIMBERS.

Eucalyptus albens, Miq.

"WHITE BOX."

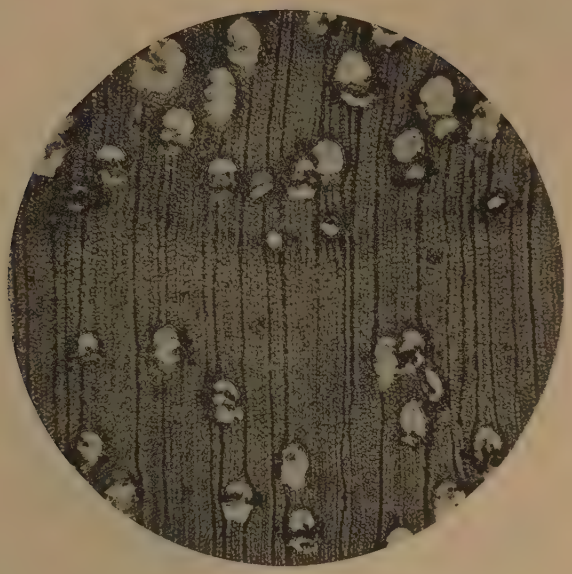
TIMBER.

DESCRIPTION AND USES.

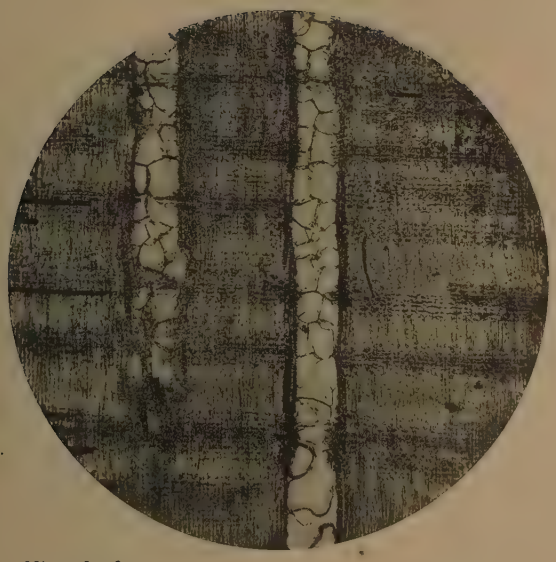
A distinct tree in the field from *E. hemiphloia*, Box, although regarded by some as only a variety. It has a pale, very hard, close-grained, interlocked timber; very durable and excellent for constructional works, bridges, wharfs, sleepers, wood blocks, fencing posts, building purposes, wheelwrights' work, mallets, mauls, handles, &c. It is, no doubt, suitable for many other purposes than those above enumerated.

H. = Very hard. W. = 72 lb. per cubic foot.

FIG. XL.



CROSS SECTION, showing regularity and evenness of fibres; a curved line in the upper half indicates late growth of wood. The dark thin lines are the rays. The absence of pores in the early wood is noticeable.



Micro. photo.]

RADIAL SECTION, showing a deposit in some of the ray cells on the left. The two vessels are closed with tyloses.

[*T. C. Roughley.*

TANGENTIAL SECTION, showing how small and numerous are the rays.

EUCALYPTUS ALBENS, MIQ.

ANATOMICAL FEATURES.

In a transverse section the pores seem to be most numerous, disposed in rings alternating with solid rings of fibres, the rays being very fine and numerous; wood parenchyma is rare; the vessels are nearly all plugged with tyloses, and the fibres forming the bulk of the timber are very compact with a very narrow lumen, the pits running longitudinally, the borders showing better in the tangential wall. It is this predominance of fibres that, no doubt, adds so considerably to the weight of the timber.

Systematic.

Not tall, but generally a finer tree than its congener, *E. hemiphloia*, F.v.M. The bark of both is very similar, being white, but not deeply furrowed. It occurs generally on higher ground than *E. hemiphloia*, Box, and the timber it considered the better of the two. Leaves lanceolate, falcate, long and broad, coriaceous, glaucous. The venation is generally prominent, the intramarginal vein is removed from the edge. Flowers in peduncles axillary, sometimes ¾ inch long. Buds long and acuminate, apparently sessile, but really tapering into short pedicels, mostly covered with whitish bloom. Operculum conical, acuminate, sometimes obtuse, almost as long as the calyx tube. Fruit obovoid, oblong, truncate, nearly 6 lines long, 3 lines in diameter, rim narrow, the capsule deeply sunk.

Baron von Mueller was inclined to consider this species a variety of *E. hemiphloia*, F.v.M., but in the field the two trees are never confounded. Its field characteristics readily differentiate it from a varietal form of *E. hemiphloia*, and are of sufficient value to give the tree specific rank.

Geographical Range.

It is fairly plentiful in South Australia, Victoria, and New South Wales.

Eucalyptus Bridgesiana, R.T.B.

"APPLE" OR "WOOLLY-BUTT"—"BUTT BUTT" OF GIPPSLAND.

TIMBER.

DESCRIPTION AND USES.

A medium hard, whitish-brown timber, fairly close grained, sapwood attacked by borers, it shrinks much in seasoning. It is only suitable for indoor work, as it decays rapidly when exposed to the air or placed in the ground. It is not used where strength and durability are required, and is fairly good for fuel.

H. = Moderate. W. = 56½ lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timbers of standard size 38 in. x 3 in. x 3 in.)

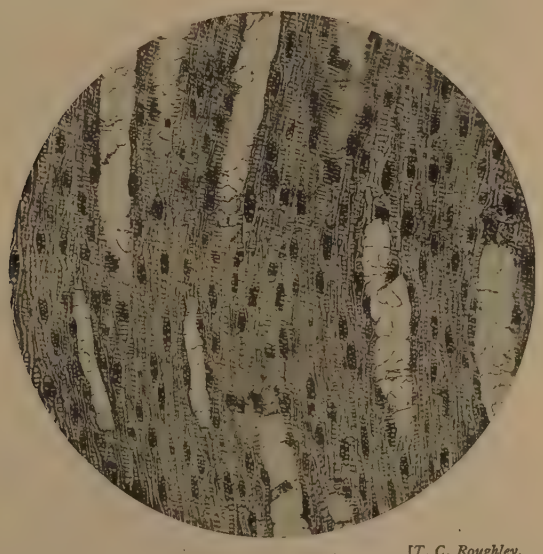
	No. 1.	No. 2.	No. 3.
Breaking load in lb.	4,570	3,490	4,160
Modulus of rupture in lb. per square inch ...	9,282	8,244	8,604
,, elasticity ,, ,, ...	1,189,762	1,658,880	1,183,163
Rate of load in lb. per minute	457	426	520

FIG. XLI.

TRANSVERSE SECTION, showing presence of large pores with tyloses; disposition of fibres and rays; a band of late wood runs obliquely through the lower portion.

Micro. photo.]

RADIAL SECTION, showing rays with and without deposit in the cells.



[*T. C. Roughley.*

TANGENTIAL SECTION, showing how the vessels, fibres, and rays run in curved planes.

EUCALYPTUS BRIDGESIANA, R.T.B.

ANATOMICAL FEATURES.

This timber has a rather unusual disposition of wood elements in some instances, when a cross section shows the fibres to occur in groups amongst the pores and wood parenchyma, the fibres predominating over all the others. The fibres have fairly thick walls with a lumen varying in diameter—the perforations are numerous and larger than those of any other species examined. The vessels have an unusual form of tyloses cells, viz., circular in some cases. Only in the ray cells was the occurrence of a secretionary deposit found. The perforations of the walls of the elements are larger than those of most Eucalypts, and this, with the unusually large amount of wood parenchyma, has some connection with the porosity of the timber, a feature which, by settlers, is considered to be, in this case, the greatest of all Eucalypts.

Systematic.

A tree of considerable size, grows to a great height, p rticularly in loam y soil. Bark whitish grey, wrinkled or tessellated, short and brittle in the grain, not fibrous, almost identical with that of the "Boxes" and when freshly cut exhales an aroma similar to the ordinary oil obtained from eucalyptus leaves. Abnormal leaves in the early stage ovate-cordate and then ovate-acuminate, petiolate or sessile, opposite or alternate. Normal leaves on rather long petioles, lanceolate, acuminate, often falcate, varying in length to over 1 foot. Lateral veins either prominent or faint, spreading, the intramarginal one well removed from the edge. Umbels capitate, axillary on flattened peduncles, bearing about seven flowers. Pedicels from 1 to 3 or 4 lines long. Tube of the calyx semi-ovate, rarely top-shaped. Operculum hemispherical, obtuse or acuminate. Fruit hemispherical, rarely conical, 3 to 4 lines in diameter, on a short pedicel, rim mostly thickened with a ring below the edge. A specimen from Araluen has quite a flange, valves exserted.

Mueller's description of *E. Stuartiana* in the Eucalyptographia applies to the "Apple" tree of Victoria, which has a red stringy bark and a red-coloured timber, and much resembles the New South Wales "Argyle Apple" (*E. cinerea*, F.v.M.). Mr. A. W. Howitt, F.G.S., a co-worker with Mueller on the eucalypts, and one who collected the original *E. Stuartiana* material for him, holds that it was the Victorian "Apple" on which Mueller founded *E. Stuartiana*, and this is substantiated by all the writings and herbarium material of the late Baron, and by those who, along with him, were familiar with the tree in the field at the time of the publication of his work on Eucalypts. *E. Bridgesiana* has a pale-coloured, compact, persistent, oil-yielding, "Box"-like bark, and a pale-coloured timber—characters entirely wanting in the "Apple" of Victoria (*E. Stuartiana*), as verified in the description given in the Eucalyptographia.

Geographical Range.

Albury ("Apple," Dr. Andrews); Gregory ("Woolly butt," J. Manns); Rylstone ("Woolly-butt," R.T.B.); Bathurst (R.T.B.); Southern half of Dividing Range, New South Wales; Gippsland, Victoria ("But But," A. W. Howitt).

Eucalyptus angophoroides, R.T.B.

"APPLE-TOP BOX." Plate 45.

TIMBER.

DESCRIPTION AND USES.

This is a little known tree, but nevertheless one that should find a prominent place in the census of trees of forestry importance, for it yields a timber with characters quite specific from any of its congeners, in fact, is a Eucalyptus timber in a class by itself. The tree is rather a rapid grower, and produces a pale oak-coloured timber, exceedingly easy

PLATE 45.

APPLE-TOP BOX.
(*Eucalyptus angophoroides*, R.T.B.)

PLATE 46.

LIGNUM VITÆ OR RIVER BOX.
(*Eucalyptus Fletcheri* R.T.B.)

to work and plane, open in the grain, and amongst "boxes" the lightest in weight. It is a timber that could be used in many branches of technology with effectiveness of colour, and more especially cabinet work, interior panelling, and wood carving. It seasons well and rapidly. It is not recommended for structural or heavy work.

H. = Moderate. W. = 49 lb. per cubic foot.

Systematic.

A medium-sized tree, with a white box bark persistent to the ultimate branchlets. Abnormal leaves ovate-acuminate, cordate, shortly petiolate, glaucous, variable in size from 1 to 3 or 4 inches long, and 1 to 3 inches broad; venation indistinct on both sides. Leaves of mature trees narrow lanceolate, about 6 inches long, acuminate, of the same colour on both faces; venation finely marked, oblique spreading, intramarginal vein removed from the edge. Peduncles axillary, 3 to 4 lines long, slightly compressed, bearing a few flowers. Calyx hemispherical to pyriform, 1 line long. Pedicel about 1 line long. Operculum hemispherical, shortly acuminate. Fruit hemispherical to slightly pear-shaped, 2 lines in diameter, and under 4 lines long; rim thick, sloping outwards, having a ring just below the edge. Valves generally four, exserted, under 1 line long.

Care must be taken not to confound it with *E. Bridgesiana* as herbarium material is somewhat similar to that species, but field observations easily differentiate the two trees, whilst the timber and oil prove that the two trees are quite different, and should not be included under the same name. *E. Bridgesiana* is known vernacularly as "Apple" and "Woolly-butt," but this tree as "Apple-top Box." The bark has not an essential oil as obtains to *E. Bridgesiana*. Although it has a regular light-coloured grey "Box" bark, yet the appearance of the foliage in the field is more like that of an "Apple-tree" (*Angophora*), hence the local name of "Apple-top Box."

Geographical Range.

South Eastern District of New South Wales.

Eucalyptus Boormani, H.D. et J.H.M.

"BLACK BOX."

TIMBER.

DESCRIPTION AND USES.

"Timber pale reddish-brown in colour, hard and durable, and according to the testimony of many observers, while of an Ironbark character, even superior to the Ironbarks of the district in which it grows. When the fruits are subcylindrical the timber is not so hard, and pale yellowish in colour." (Maiden.)

Systematic.

An average forest tree, with a very dark-grey and even black bark. In texture scaly, sometimes hard, and even in parts nearly as rugged as an Ironbark, but never as soft as a Box. The rough bark extends to the small branches. Abnormal leaves broad and coarse, nearly orbicular, but early becoming lanceolate. Normal leaves ovate-lanceolate to lanceolate, usually 3 to 6 inches long, and over 1 inch in breadth. Veins fine and rather spreading, the intramarginal vein usually quite close to the edge. The buds and stamens appear not to differ from those of *E. siderophloia*, and conical like that species. Fruit nearly semi-ovate, often slightly angular, presenting a good deal of resemblance to those of *E. siderophloia*, but the valves (which usually number four and sometimes five) scarcely exserted, about 3 to 4 lines in diameter, and not contracting at the orifice. Sometimes so subcylindrical in shape as to exhibit considerable resemblance to those of typical *E. hemiphloia*.

Geographical Range.

Bankstown and Cabramatta Districts; thence across country to Penrith, Lue on the Mudgee line, New South Wales.

Eucalyptus Fletcheri, R.T.B.

"RIVER BOX." Plate 46.

TIMBER.

Description and Uses.

A splendid foliaceous tree occurring on the banks of streams in the south-east of the Continent, and one worthy of forestry consideration, for its timber was so highly appreciated in its habitat near Sydney, that it was soon cut out by early settlers, as it is probably one of the strongest and hardest timbers amongst Eucalypts.

It is pale-coloured with a darker tinge towards the centre, very hard, tough, interlocked, and durable, and a very desirable timber for heavy architectural works, bridging, sleepers, posts, heavy carriage work, wharves, and wheelwrights' work.

H. = Very hard. W. = 66½ lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timbers of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	6,100	5,530
Modulus of rupture in lb. per square inch ...	12,448	11,440
,, elasticity ,, ,, ...	1,345,300	1,301,900
Rate of load in lb. per minute	762	790

Systematic.

A medium-sized tree, with a "Box" bark on the trunk. Branches smooth, branchlets glaucous. Leaves from orbicular to ovate-acuminate in shape, sometimes oblique, cuneate or rounded at the base, from 1 to 3 or 4 inches in width, thin, not shining. Venation faintly marked, lateral veins oblique, spreading, intramarginal vein removed from the edge, but more pronounced at the base, giving a trinerved appearance to the leaf. Flowers numerous in axillary or terminal panicles. Peduncles short, 2 to 3 lines long. Buds about 5 lines long. Calyx conical, with scarcely any pedicel. Operculum hemispherical, very shortly acuminate or obtuse. Fruit conical, about 4 lines long, 3 lines broad; rim thin, and mostly in mature fruits with a notch, capsule sunk.

Geographical Range.

Banks of rivers and creeks from near Sydney into Eastern Victoria.

Eucalyptus conica, H.D. and J.H.M.

"FUZZY BOX—"COOLABAH BOX."

TIMBER.

DESCRIPTION AND USES.

A timber with the average "Box" wood qualities, being of a light-brown colour, very hard and close-grained. Suitable for bridge work, heavy waggon construction, bearers for machinery, posts, rails, sleepers, wood blocks, and general hardwood uses.

H. = Very hard. W. = 67 lb. per cubic foot.

Systematic.

A tree of medium size, with pendulous branches. Bark of ordinary "Box" character, persistent right on to the small branches. Abnormal leaves broadly ovate, the intramarginal vein considerably distant from the margin, and with the midrib giving the leaf a triplinerved appearance. Normal leaves lanceolate, ultimately narrow-lanceolate, 4 inches long by ½ inch broad, varying however in length and width. The intramarginal vein is distinctly removed from the edge of the leaf. The venation is oblique. Buds clavate, the calyx-tube greatly exceeding the operculum in size. The operculum nearly hemispherical, the calyx-tube tapering gradually. The inflorescence in panicles, the individual umbels having a maximum of six or seven flowers, small in the bud. Fruit narrow, conical (hence the specific name), tapering to the point of attachment of the common stalk, greatest length 5 lines by 2 lines broad; thin rim. The valves, which are three or four and very small, are deeply sunk; of a pale brown colour and shining.

Geographical Range.

Found in much of the country west of the Dividing Range and its spurs, forming, with *E. hemiphloia* and *E. Woollsiana*, the "Box" of the western country (R. H. Cambage), New South Wales.

*Eucalyptus gomphocephala, DC.

"TUART." Plate 47.

TIMBER.

DESCRIPTION AND USES.

An important commercial tree of Western Australia. Although of rather limited geographical range, being restricted or confined to the limestone belts lying along the coast between Perth and Basselton, its timber is regarded as the strongest, heaviest and toughest in Western Australia. It is extraordinarily hard, and so interlaced in the grain that it is difficult to split, and is most durable. In colour it much resembles *E. microcorys*, Tallow-wood. Its chief uses are railway waggons, buffers, engine bearings, keelsons, stern posts, bridge supports, frames, wheelwrights' work generally, shafts, and most other works where great strength, solidity, and hardness are required.

The wood is a greyish-yellow colour, and so dense that it is difficult to work.

H. = Very hard. W. = 70 lb. per cubic foot.

Systematic.

A tree of 150 feet in height and 20 feet in girth, with a smooth or rough persistent bark. Leaves ovate-lanceolate to narrow-lanceolate, mostly falcate and acuminate, often exceeding 6 inches, thick and shining, the fine, rather numerous, oblique veins scarcely conspicuous, except on old leaves. Flowers axillary, on lateral peduncles, thick and hard, broad and flat, ½ to 1 inch long, each with three flowers, either sessile, or on very short, thick, flat pedicels. Calyx tube obovoid or somewhat urceolate, 4 to 5 lines long, and nearly 4 lines diameter. Operculum globular, very thick and hard, broader than the calyx-tube, usually nearly ¼ inch diameter. Fruit ⅔ inch long, somewhat dilated at the orifice, the rim broad and convex, the capsule scarcely sunk, conical in the centre, the open valves protruding.

Geographical Range.

This Species is restricted to the south-west portion of the Continent.

*Eucalyptus hemiphloia, F.v.M.

"BOX" OR "GREY BOX." Plate 48 and Bark 48A.

TIMBER.

DESCRIPTION AND USES.

A typical forest tree of Australia and one having a wide distribution in the Eastern States with the characteristic "Box" bark. It is a shapely tree, and worthy of cultivation for the valuable hardwood it produces. It is rarely classified as Box amongst timber merchants, but sold like most others as a "hardwood." It is pale-coloured, hard, and best suited for heavy constructional works, wharves, piles, sleepers, bridges, bridge decking, and any work requiring strength and weight.

H. = Very hard. W. = 68½ lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timbers of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	10,290	8,540
Modulus of rupture in lb. per square inch ...	21,072	17,548
,, elasticity ,, ,, ...	2,779,100	2,585,400
Rate of load in lb. per minute	1,029	1,067

Systematic.

An average forest tree. Bark persistent, grey, extending to the base of the branches, which are smooth, or with a flaky bark. Leaves ovate-lanceolate, acuminate, sometimes up to 5 or 6 inches in length, greyish on both sides; veins not prominent, lateral ones oblique, the intramarginal vein removed from the edge Flowers mostly in umbels, forming terminal panicles. Calyx tapering into a short, angled pedicle. Operculum conical, and as long as the calyx tube. Fruit cylindrical, 3 lines long and 2 lines in diameter; rim thin, valves quite enclosed.

E. hemiphloia is the common "Box" of the Coast and Dividing Range, and is distinct from any of the "Box" trees of the interior. This tree can be distinguished from *E. albens* by its smaller fruit and smaller leaves, and an absence of glaucescence on its branchlets, leaves, and buds.

Geographical Range.

Distributed throughout the whole Coastal area, and well into the Tableland of New South Wales; South Australia; Victoria and Queensland.

PLATE 47.

TUART.

(*Eucalyptus gomophocephala, DC.*)

PLATE 48.

GREY BOX.

(*Eucalyptus hemiphloia*, F.v.M.)

PLATE 48A.

BOX BARK.

(*Eucalyptus hemiphloia*, F.v.M.)

Eucalyptus quadrangulata, H.D. et J.H.M.

"GREY BOX."

TIMBER.

DESCRIPTION AND USES.

A tree that requires consideration, with a view to its forestry culture, as at present it is only known from one locality in New South Wales, for it yields a splendid hard, pale-coloured, heavy timber, and one that would be quite an addition to our list of such valuable woods under an afforestation scheme. It is pale-coloured, interlocked, and not much unlike, in general facies, *E. hemiphloia*. It is one of the best "White Box" timbers of New South Wales, and would make a good substitute for English Ash, but unfortunately, as stated above, its distribution is limited.

H. = Very hard. W. = 63 lb. per cubic foot.

Systematic.

A tree of 80 to 100 feet in height and a diameter of 2 to 4 feet. Bark very much resembles that of ordinary "Box," *E. hemiphloia*, in general appearance, but is more fuzzy and softer than the latter. Abnormal leaves narrow-lanceolate, cordate and clasping at the base, strictly opposite, markedly paler on the under surface. Leaf branchlets angular; leaves lanceolate or narrow-lanceolate, slightly falcate, usually 4 to 6 inches long, scarcely paler on the under surface. Venation conspicuous on both sides, the intramarginal vein well removed from the edge, the lateral veins spreading. Umbels axillary, consisting usually of four to eight sessile flowers in the head. The calyces subconical and exceeding the operculum, which is concoid, the calyces sometimes angular. Fruit small, shining, bell-shaped; rim medium, the valves slightly exserted, and usually three in number.

Geographical Range.

Hill Top, Milton, and Mittagong, New South Wales.

Eucalyptus Raveretiana, F.v.M.

"THOZET'S BOX" OR "IRON GUM TREE."

TIMBER.

DESCRIPTION AND USES.

Bailey, Q.Fl., Vol. II, p. 623, records of this timber that it is of a dark drab colour, speckled with white lines; close-grained, very hard, and tough; valuable for building purposes, and would be useful for cabinet work.

Systematic.

A tall, erect tree, said to attain the height of 300 feet, trunk 3 or 4 feet in diameter; bark dark, scaly, persistent, except on the upper branches, branchlets angular. Leaves chartaceous, ovate to elongate-lanceolate, slightly falcate, 3 to 5 inches long, ¾ to 1¼ inch broad, almost equal-sided at the base, pale on the under side. Veins fine and somewhat distant, the intramarginal one near the edge. Flowers in panicles, axillary and terminal, 1 to 3 inches long, few or many small flowers in each umbel. Pedicels 1 to 2 lines long. Operculum acutely conical, longer than the calyx-tube. Fruit scarcely exceeding 1 line broad, three or rarely four-celled, the valves half-exserted. Seeds angular.

Geographical Range.

Rockhampton, Dawson and Nercool Rivers, and near Port Denison, Queensland.

*Eucalyptus melliodora. A.Cunn.

"YELLOW BOX." Plate 49.

TIMBER.

Description and Uses.

One of the most umbrageous trees in the Australian forests, and some fine specimens of it can be seen for miles from Albury to Goulburn, N.S.W.

The common name is not given to the tint of the timber, but from the yellow colour of the inside of the bark, by which character the bushmen distinguish the species. The timber is pale-coloured, very durable, and much resembles "White Box," *E. albens*, in these qualities, but subject to pipe in the centre.

It is suitable for bridge-decking, piles, shipbuilding, sleepers; posts made from it are very durable in the ground. It could be used for all kinds of heavy constructional work.

H. = Very hard. W. = 61 lb. per cubic foot.

Anatomical Features.

The fibres may be classed as thick-walled, of a rather uniform dimension, with a lumen about one third of the whole diameter. The perforations are numerous, opening by long tudinal slits which are often bordered. The pores are very numerous. The vessels have a rather delicate system of tyloses, and, like the wood parenchyma (which is rather sparsely found), have no secretionary substance as obtains in so many eucalypts. The rays are small, numerous, uniseriate, and only a few of the cells have a yellowish secretion. In fact, this absence of a secretionary substance in the wood elements is rather an exception amongst the hardest woods of the Genus. The radial wall perforations of the cells are unusually large, round, and not of uniform diameter.

Systematic.

Generally a very fair-sized tree. Bark persistent, smooth, buff-coloured, or sometimes rugged towards the base, of a rich yellow colour on the inner side. Abnormal leaves oval, or ovate lanceolate, thin, variable in size, venation faintly marked. Lateral veins parallel, distinct, intramarginal vein much removed from the edge. Leaves of mature trees lanceolate to ovate-lanceolate, under 6 inches long. Venation not well marked, except the intramarginal vein, which is removed from the edge, and is so distinct at the base as to give a trinerved appearance to the leaf. Dries a pale yellow colour. Peduncles short, axillary, slender, with about six flowers in the umbel. Calyx scarcely 2 lines in diameter, conical, on a pedicel of about 2 lines. Operculum short, hemispherical, obtuse. Fruit mostly hemispherical, but occasionally pyriform, under 3 lines in diameter; rim thin, sometimes with a constriction immediately below it. Capsule sunk. Valves not exserted.

Geographical Range.

Tableland from Queensland into Victoria.

PLATE 49.

YELLOW BOX.
(*Eucalyptus melliodora*, A. CUNN.)

PLATE 50.

MALLEE BOX.
(*Eucalyptus Woollsiana*, R.T.B.)

FIG. XLII.

CROSS SECTION. showing smallness of fibres in this view; numerous pores and rays

Micro. photo.]

RADIAL SECTION, with vessels of varying diameters; a deposit is seen in several of the ray cells.

[*T. C. Roughley.*

TANGENTIAL SECTION. A deposit forms a conspicuous feature in most of the rays seen end on.

EUCALYPTUS MELLIODORA, A. CUNN.

Eucalyptus bicolor, A.Cunn.

"FLOODED BOX."

TIMBER.

DESCRIPTION AND USES.

A typical "box" tree, having a hard, close, straight-grained, pale-coloured timber, and extremely durable. Suitable for bridge-decking, heavy coach and waggon work, railway sleepers, fencing and general constructional works.

H. = Extremely hard. W. = 63 lb. per cubic foot.

Systematic.

A medium-sized tree, with "Box" bark on the lower portions of the stem. Leaves lanceolate, but very variable in size, from broad lanceolate (2 inches broad and over 6 inches in length) to narrow lanceolate (2 lines broad and over 6 inches long), ovate, acuminate under 4 inches long, dull or slightly shining, uniform green on both sides; venation distinct, lateral veins oblique, intramarginal vein removed from the edge, and markedly so in the broad lanceolate and ovate forms of leaves. Flowers in peduncles axillary, 4 to 5 lines long, with six or more flowers in the umbel. Calyx 1¼ line in diameter at the time of flowering, hemispherical. Operculum hemispherical, acuminate 1½ line long. Ovary flat-topped. Fruit hemispherical, under 3 lines in diameter; rim flat or slightly countersunk. Valves not exserted.

Geographical Range.

Cabramatta, St. Mary's, New South Wales.

Eucalyptus Stoneana, Bail.

"GUM-LEAVED BOX."

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey, Q. Ag. Jour., Vol. XXIII. pp. 259-260, states:—"No special use is at present made of this timber. The outer part is yellow and the inner red."

Systematic.

A large tree, with a rather close, hard, persistent greyish bark, about ½ inch thick. Leaves alternate, thin, coriaceous, 6 to 10½ inches long, from 7 lines to 3 in width, broadest and roundly-cuneate at the base, midrib alone prominent, principal parallel transverse veins distinct, but faint like the reticulate veins, the intramarginal one always close to the edge of the leaf. Flowers about 1 inch in diameter in axillary panicles elongated, primary peduncles about 1 inch long, secondary 9 lines, bearing umbels of from two to six flowers, often somewhat crowded at the end of the branchlets. Operculum thin, hemispherical, or with a very minute point. Fruit oval-globose, including the pedicellate, lower half about 8 lines long, diameter about 4 lines at the top, the outside upper portion smoothish, the lower pedicel-like portion angular; rims thin, capsule deeply sunk, the top dome-shaped. Mr. Maiden states, Proc. Roy. Soc., N.S.W., Vol. XLVII., p. 82:—"*E. leptophleba*, F.v.M., has *E. Stoneana* as a synonym."

Geographical Range.

Stannary Hills, Queensland (Dr. Bancroft).

Eucalyptus Woollsiana, R.T.B.

"MALLEE BOX." Plate 50.

TIMBER.

DESCRIPTION AND USES.

This is a giant tree amongst its congeners of the Mallee scrub of the interior, and so is of forestry importance, as it is a big tree growing where such do not usually flourish. The timber differs in no way from that of other pale box-woods, being heavy, close-grained, interlocked and durable, so is an excellent timber for heavy constructional works such as bridges, posts, wharfs, railway sleepers, cars, waggons, wood blocks, coach or wheelwrights' work. It is in great request at the Cobar mines for shoring the roofs. It may be regarded as one of the best of the Boxes for afforestation in the country with a small rainfall.

H. = Extremely hard. W. = 64 lb. per cubic foot.

Systematic.

A large tree, up to 80 feet high, and more than 3 feet in diameter. Bark persistent half-way or more up the trunk, smooth, chiefly of a rich brown colour. Abnormal leaves lanceolate, alternate, 2 to 3 inches long, ½ to ¾ inch broad. Normal leaves under 6 inches long, narrow-lanceolate, tapering to a fine, recurved point, mostly of a thin texture, of a light-yellowish green, generally shining. Venation slightly obscured, impressed on the upper surface. Lateral veins few, intramarginal vein removed from the edge. Peduncles axillary, from 2 to 12 lines long. Flowers few. Calyx about 1 line in diameter, tapering into a short stalk. Operculum hemispherical, acuminate, and often more obtuse than shown in the plate. Fruit small, 1 line in diameter, hemispherical to slightly pear-shaped; rim thin, slightly contracted, valves not exserted.

Geographical Range.

Interior of New South Wales, Victoria and South Australia.

Eucalyptus odorata, Behr.

"BOX."

TIMBER.

DESCRIPTION AND USES.

A pale-coloured timber of a hard nature, suitable for posts, fencing and fuel.

J. E. Brown states:—In specific gravity, the wood weighs from sixty or seventy pounds per cubic foot. It is very hard, durable, yellowish-white in colour, and is considered of fair quality, has a tough fibre, and is used for such purposes as naves, felloes, rails, slabs and fence posts. As a rule the tree is too small to be available for general sawing purposes, since it is almost invariably hollow both in trunk and branchlets.

H. = Very hard. W. = 63 lb. per cubic foot.

58699—M

Systematic.

A small tree, with a persistent "Box"-like bark. Leaves lanceolate, usually narrow, stalk not long, mostly under 4 inches long, and rigid, of a dull green or somewhat shining; the veins oblique, not numerous, the intramarginal one at some distance from the edge. Peduncles mostly axillary, about the same length as the petiole, pedicels rather short. Calyx cylindrical, about 2½ lines long. Operculum short, hemispherical, obtuse. Fruit obovoid-truncate, about 2 lines in diameter, slightly contracted at the orifice, tapering at the base, the capsule deeply sunk.

This is essentially a South Australian Eucalypt, and only occurs in patches in the south-east portion of New South Wales. It has several different common names in the localities of its distribution. The delineation in Mueller's Eucalyptographia of this tree does not agree with that given by J. E. Brown in his "Forest Flora of South Australia." The author has been unable to refer to Behr's original description, and that given above is from Bentham's "Flora Australiensis." The term "Peppermint" should not be applied to this tree, as the peppermint constituent, peperitone does not occur in the oil. The vernacular term "Box," therefore, indicates the general characteristics for this tree.

Geographical Range.

Southern interior of South Australia, and in the south-west of both Victoria and New South Wales.

*Eucalyptus Bosistoana, F.v.M.

"RED BOX."

TIMBER.

DESCRIPTION AND USES.

One of the finest trees in the Australian bush, and one of some forestry importance, that should, when duly cultivated, become of commercial significance, for it produces an excellent, very pale pink-coloured hardwood having a close grain. It is suitable for heavy constructional works, heavy waggons, carriages, bridges and sleepers, and, judging from its texture, would be durable in the ground as posts, fencing, piles, &c.

H. = Extremely hard. W. = 69 lb. per cubic foot.

Systematic.

This tree was the last Eucalyptus described by Baron von Mueller (1895), and has, therefore, only quite recently been botanically placed. Its other vernacular name is "Grey Box-tree" (Mueller). It is a tall tree, running up to over 150 feet in height, and 3 to 4 feet in diameter, with a symmetrically shaped head. Bark rough on the trunk at the base, but smooth towards and on the branches, and stained in places with kino exudations. Leaves variable in shape, on the younger trees broad to lanceolate, of the same colour on both sides, often oblique, the intra-marginal vein removed from the edge. In mature trees the leaves are much narrower and more acuminate, lateral veins fairly distinct and oblique, petiole, rather long and slender. Umbels axillary or terminal, few buds in the heads. Young buds somewhat like those of *E. pilularis*, "Blackbutt." Operculum semi-ovate, hemispheric, often distinctly pointed (F.v.M.). Fruit pilular, about ¼ inch in diameter; rim truncate. Cells numerous. Valves not exserted.

Geographical Range.

Southern Coastal Range Districts of New South Wales and well into Victoria.

(*b*) RED TIMBERS.

*Eucalyptus largiflorens, F.v.M.

"RED BOX."

TIMBER.

DESCRIPTION AND USES.

A tree with a pendulous habit, growing on the banks of our inland rivers. Wood pale reddish coloured, hard, heavy, close-grained, interlocked and durable. Suitable for bridge-work, sleepers, wood blocks, posts, fencing, and heavy constructional work.

H. = Extremely hard. W. = 70 lb. per cubic foot.

Systematic.

A tree in favourable situations attaining a height of 100 feet, and vernacularly known as "Goborro" in some parts of the State. Bark persistent, ashy grey or blackish. Branches more or less drooping, sometimes as much as those of the Weeping Willow. Leaves lanceolate, elliptical, shortly acuminate, of a rather thick texture, silvery-grey on both sides, petioles not long. Veins few, not distinct, the intramarginal one much removed from the edge. Flowers small, sometimes red, in axillary or terminal panicles, almost sessile. Operculum hemispherical. Fruit under 2 lines in diameter, somewhat pilular in shape, the orifice contracted, valves enclosed, and the capsule sunk.

Geographical Range.

From the Bogan to the Lachlan and Murrumbidgee, New South Wales; South Australia; Victoria; Queensland; North Australia.

*Eucalyptus microtheca, F.v.M.

"COOLABAH."

TIMBER.

DESCRIPTION AND USES.

A splendid tree for the far west afforestation, as it resists all the highest temperatures so far recorded, and yields an excellent hardwood of a deep red colour in the centre, and light grey sapwood. It is very tough, interlocked, and suitable for heavy bridging, sleepers, and any purpose requiring strength and weight.

H. = Extremely hard. W. = 72 lb. per cubic foot.

ANATOMICAL FEATURES.

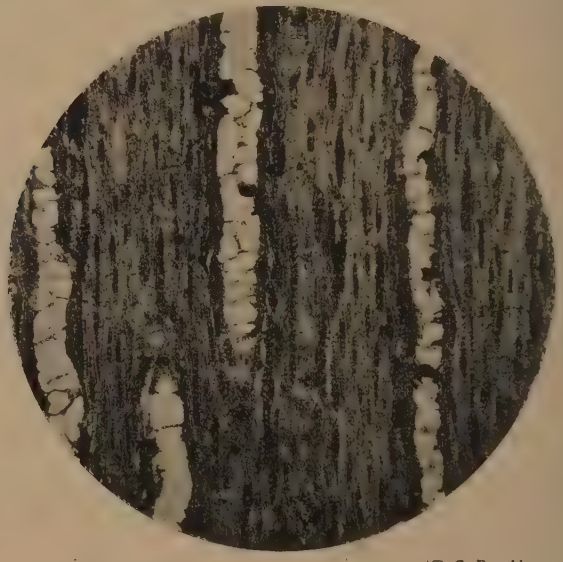
A very close compact timber, in fact, so much so, that in a transverse section macroscopically examined it appears to closely resemble an Ironbark. The fibres are very closely packed, running in radial lines,

FIG. XLIII.

CROSS SECTION, showing the compactness of the fibres, and rays; pores mostly have tyloses, the wood parenchyma being indicated by black spots amongst the fibres.

Micro. photo., [*T. C. Roughley.*

RADIAL SECTION, showing the rays and wood parenchyma with a red deposit; crystals towards the left are shown.



TANGENTIAL SECTION, showing fibres, rays and vessels blocked by tyloses.

EUCALYPTUS MICROTHECA, F.v.M.

having thick walls, leaving a very narrow lumen, nearly always filled with a secretionary substance, similar to the parenchyma; the perforations partake of the character of bordered pits, and are very numerous in all walls. The pores are numerous, but not arranged in any regular rings. The vessels all have tyloses, and are small-chambered by the partition walls. The perforations are identical with those of the fibres, but more numerous. The wood parenchyma is not clustered around the pores, but scattered irregularly amongst the fibres; the rays are numerous, and range from uniseriate to three and four cells in width, and a few in height. The wood elements are not arranged in any regular circular system or method, and thus the annular rings are not well marked.

Systematic.

A tree attaining a height of 80 feet, and a stem diameter of 4 feet. Bark rough, more or less dark or ashy-grey outside, sometimes persistent, but occasionally smooth. Leaves lanceolate, falcate, always drying a light slate colour, oblique, measuring sometimes up to 8 or 9 inches in length length and ¾ inch in width, on a petiole of 1 inch or 1½ inch long. Venation fairly prominent, intramarginal one not far removed from the edge. Flowers mostly in terminal panicles. Calyx small, almost hemispherical. Operculum conical, acuminate. Anthers small, opening by longitudinal slits. Fruits small, hemispherical, under 2 lines in diameter; rim thin, valves much exserted and convex.

Geographical Range.

From Narrabri to the deserts of the north-west of New South Wales; South Australia; Queensland; North Australia.

*Eucalyptus polyanthemos. Sch.

"RED BOX." Plate 51.

TIMBER.

DESCRIPTION AND USES.

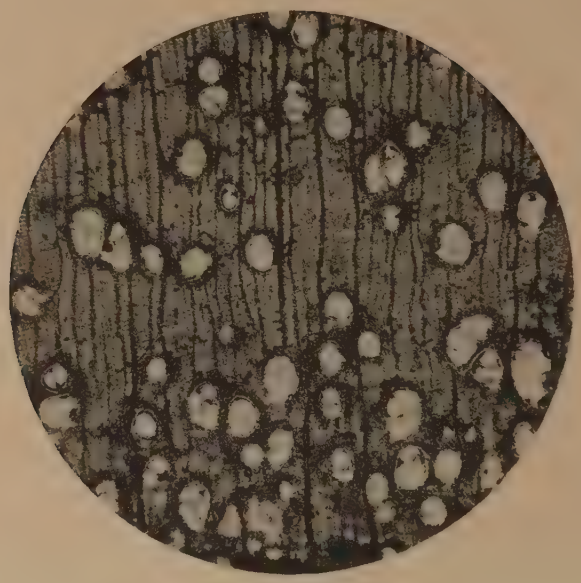
This species yields a dark, red-coloured, hard timber, with a very fine, close, interlocked grain, which gives it great strength. Suitable for building purposes, bridges, coach and waggon work, carriage framing, sleepers, and wood blocks, being very durable in the ground. One of the best redwood timbers of the Genus.

H. = Extremely hard. W. = 67 lb. per cubic foot.

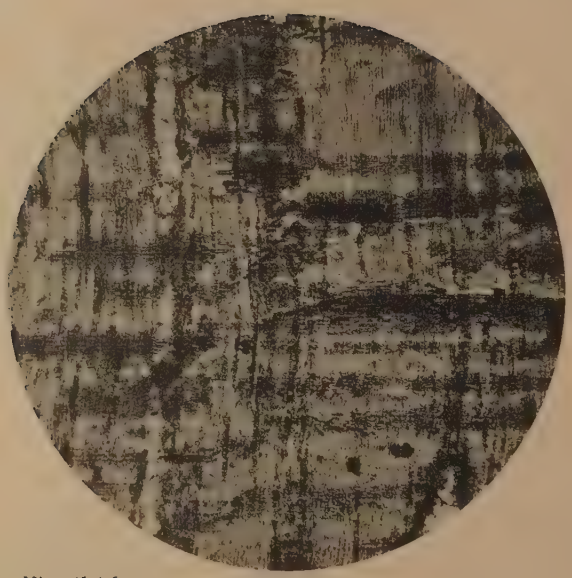
ANATOMICAL FEATURES.

A very compact timber, the most conspicuous feature being the presence of a brown or red substance in the wood elements, except the vessels. The fibres are arranged in fairly regular radial rows, the walls of a little more than medium thickness, with numerous perforations, seen best in the longitudinal sections; the lumen being filled with a brown substance. The pores are very numerous and, like the cells of the vessels, are rather small. The wood parenchyma is numerous and scattered amongst the vessels and fibres, or occurring in concentric rings with the season's growth, and contains the brown substance

FIG XLIV.



CROSS SECTION, cut where the pores are most numerous; wood parenchyma small and mostly occurring around the pores.



Micro. photo.]

RADIAL SECTION, showing how most of the wood elements are filled with a deposit (red).

[*T. C. Roughley.*

TANGENTIAL SECTION, showing compactness of wood elements.

EUCALYPTUS POLYANTHEMOS, SCH.

PLATE 51

A RED BOX.

(*Eucalyptus polyanthemos*, SCHAU.)

PLATE 52.

COAST RED BOX

(*Eucalyptus Rudderi*, J.H.M.)

referred to above. The rays are very numerous and in a cross section appear to bulge with the pressure of the cell content; they vary from one to two cells wide and a few cells in height. Some crystals were detected.

Systematic.

Perhaps this tree is characterised principally by its hard red timber and persistent "Box" bark right out to the branchlets. *E. ovalifolia*, R.T.B., which is also locally known by the name of "Red Box," is not to be confounded with *E. polyanthema*, Schau, as it has a smooth, white bark and characteristic leaves, which differ from those of *E. polyanthema* and *E. Fletcheri*; *E. Dawsoni*, R.T.B., "Slaty Gum" is also quite a distinct tree from *E. polyanthemos*, Schau. It is a fair-sized tree. Leaves oval, ovate-acuminate or emarginate to lanceolate, the latter form about 3 inches long, and the former generally under 3 inches long, glaucous, thin to almost coriaceous, petiole rather slender, measuring sometimes over an inch long. Venation strongly marked, intramarginal vein removed from the edge, particularly so in the "sucker" leaves. Lateral veins oblique, distant. Flowers in terminal or axillary panicles. Calyx under 2 lines, tapering into a short pedicel. Operculum hemispherical, shortly acuminate. Fruit pear-shaped, under 3 lines in diameter; rim thin, contracted, notched.

Geographical Range.

New South Wales (Pambula, Bungendore, Albury, Delegate River) and Victoria.

*Eucalyptus Rudderi. J.H.M.

"COAST RED BOX." Plate 52.

TIMBER.

Description and Uses.

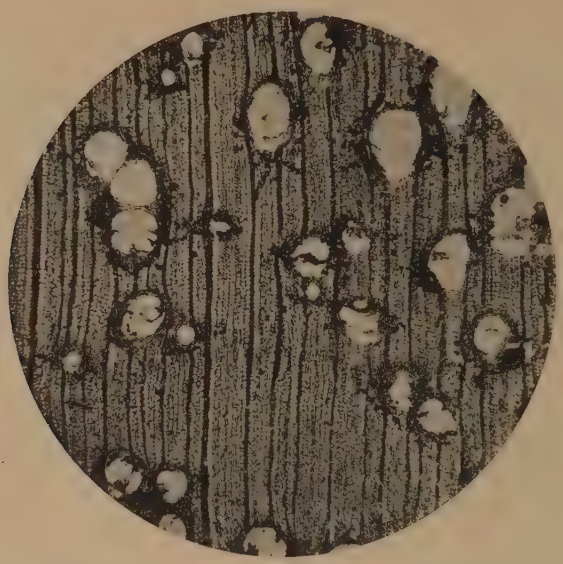
One of the finest of our forest trees, yielding a strong red hardwood timber suitable for the building trade, heavier kinds of bridge-work, shipbuilding, and certain parts of boat construction. It is close-grained, heavy, planes well and gives a rich red colour when polished, but little is known on the market of this timber at present. It is well suited for heavy cabinet work.

H. = Very hard. W. = 63 lb. per cubic foot.

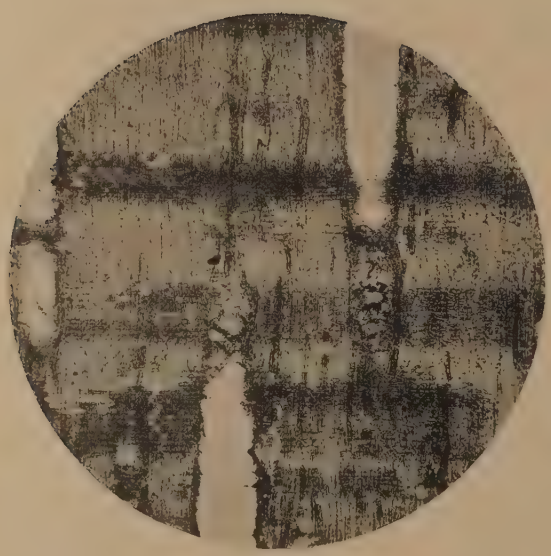
Anatomical Features.

A close compact timber, the fibres largely predominating in number over the other wood elements, they are arranged in radial rows, with thick walls, and rather small lumen which is filled with a red substance. The perforations occur in all the walls, but it is noticed that the tendency is for those next to the rays, for the pits to open into these, and those midway, especially to communicate with each other radially. The pores are fairly numerous, and the wood parenchyma scattered amongst the fibres is very sparse. The vessels are of limited divisions between the partition walls, and all the perforations are of the bordered pit variety and very numerous. The rays are small and numerous and mostly uniseriate, the cells being filled with a red material; the perforations are very large. The material enclosed in the fibres is a conspicuous feature in a radial section, appearing like a red line undulating in the middle, tapering off at both ends like a fine needle.

FIG XLV.



CROSS SECTION, showing compactness and regularity of fibres; numerous pores; and rays in dark lines.



Micro. photo.]

RADIAL SECTION, showing parts of several rays with deposits —a substance also seen in the wood parenchyma; portions of three vessels and compact fibres.

[*T. C. Roughley.*

TANGENTIAL SECTION, with portion of vessel on the left; wood parenchyma from top right, rest composed of fibres and rays.

EUCALYPTUS RUDDERI, J.H.M.

Systematic.

A red box-tree, 120 feet high and 2 to 3 feet in diameter. Abnormal leaves lanceolate to oval, acuminate, 4 to 5 inches long and 1½ inches broad. Intramarginal vein removed from the edge. Normal leaves narrow to broad lanceolate, under 6 inches long. Venation fairly distinct. Lateral veins oblique. Intramarginal vein removed from the edge, drying a bluish colour. Flowers in panicles, with about three to six in the umbel. Calyx top-shaped. Operculum conoid. Fruits small, ¼ inch long and ¼ inch in diameter, pear-shaped; rim thin, valves not exserted, almost identical with those of *E. crebra*.

Geographical Range.

Thirlmere, Grose River, Taree, Bohnock to Gloucester, New South Wales. (J. H. Maiden.)

Eucalyptus populifolia, Hook.f.

"BIMBIL" OR "POPLAR-LEAVED BOX."

TIMBER.

DESCRIPTION AND USES.

This Eucalyptus occurs in the interior of the North and Eastern States and possesses a reddish-brown coloured timber, very tough and strong, hard, difficult to work, but is a handsome wood when polished. It could be used in house-building, waggon work, sleepers, posts and rails, and smaller parts of bridge-work.

H. = Extremely hard. W. = 76 lb. per cubic foot.

Systematic.

A medium-sized tree. Bark persistent on the stem and branches, rough, not deeply furrowed, sometimes whitish or khaki-coloured, between a "Box" and a "Woolly-butt" in character. Abnormal leaves oval to ovate-acuminate, 2 inches long, shining on both sides. Venation distinct, lateral veins few, spreading, intramarginal vein removed from the edge. Leaves variable in size and shape, from ovate-acuminate, ovate-lanceolate to narrow lanceolate, under 6 inches long. Venation and other features similar to that of abnormal leaves. Flowers numerous in axillary or terminal panicles, peduncles slender, under 6 lines long. Calyx turbinate, 1 line long and 1 line in diameter, also on a pedicel of about 1 line. Operculum hemispherical, shortly acuminate. Fruit small, pear-shaped to hemispherical, under 2 lines long; rim truncate, valves not exserted.

Geographical Range.

Northern half of the Central Division of New South Wales; Queensland and North Australia.

Eucalyptus hybrida, J.H.M.

TIMBER.

DESCRIPTION AND USES.

Timber pale coloured, hard, interlocked and probably valuable (J. H. Maiden).

Systematic.

A typical forest tree probably reaching 100 feet high, with a persistent, box-like bark, greyish or blackish externally. Hence some trees have been described as "Black Box." Leaves lanceolate or broadly lanceolate, slightly falcate, acuminate, commonly 8 to 12 cm. long. Dull green, the same colour on both sides, rather thin and tough, lateral veins spreading, fine, the intramarginal vein not far removed from the edge to the leaf. Flowers on peduncles of moderate length, angular, usually in a short corymbose panicle, each with about three to six, or sometimes more, flowers. Calyx-tube conoid, about ¼ inch in diameter, often angular, tapering into a short pedicel. Operculum pointed and as long as the calyx-tube. Fruit when immature cylindrical, with a rim round the orifice. When ripe cylindrical to almost conoid, about ½ inch in diameter, hardly constricted at the orifice; rim thin, tips of the valves more or less sunk, and rarely flush with the orifice.

Geographical Range.

Concord and Hawkesbury District, New South Wales. (J. H. Maid n.)

Eucalyptus affinis, H.D. et J.H.M.

TIMBER.

DESCRIPTION AND USES.

A very hard, dark red, close-grained, tough, interlocked timber, much resembling *E. intertexta*, and could be used for purposes where strength and durability are required. It is difficult to work, but may be suitable for sleepers, wood blocks, heavy waggon and wharf construction.

H. = Very hard. W. = 65 lb. per cubic foot.

Systematic.

A tree of moderate size, attaining a height of 80 feet, and a diameter of 2 feet 6 inches. Abnormal leaves alternate, ovate, obtuse, slightly emarginate and mucronate, about 3 inches long by 1¾ inch broad; intramarginal vein at a considerable distance from the edge. Normal leaves lanceolate, slightly falcate, pale-coloured, dull on both sides, rather coriaceous, usually 2 to 3 inches long. Veins at an angle of about 30 degrees with the midrib, but inconspicuous, except the midrib and the thickened margin. Intramarginal vein inconspicuous, and at some distance from the edge. Peduncles axillary, flattened at first, but nearly terete when the fruit is ripe, with three to seven flowers. Buds tapering equally towards base and operculum, somewhat angular, the operculum attenuate. Calyx-tube likewise attenuate, tapering into a short pedicel. Fruit ovate-truncate, tapering at the base, somewhat contracted at the orifice, about 3 lines in diameter, the rim narrow slightly convex and dark-coloured. The capsule depressed.

Geographical Range.

The Western District of New South Wales, Wellington, Dubbo, Molong and Parkes.

Eucalyptus Brownii, J.H.M. et R.H.C.

"BOX TREE."

TIMBER.

DESCRIPTION AND USES.

Timber red (J.H.M. et R.H.C.). No other data available.

Systematic.

A medium-sized Box tree, about 40 feet high, erect, rather drooping. Bark hard, thin, flaky, box-like bark, on the trunk and large branches, the ultimate branchlets smooth. Abnormal leaves lanceolate or narrow lanceolate, generally long and narrow, equally green on both sides. Venation distinct, spreading, intramarginal vein distinct from the edge. Normal leaves lanceolate, except as regards the size the description of the abnormal leaves applies. Lateral veins arranged at angle of about 30 degrees with midrib. Buds small, clavate, operculum hemispherical or slightly umbonate, and about half the length of the calyx-tube which tapers gradually into the pedicel. Flowers paniculate, the individual umbels three to nine in the head. Fruits small, conoid, about 3 cm. in diameter, and the calyx-tube about the same length, tapering not perfectly gradually, into the pedicel; rim thin, tips of the valves flush with the orifice, which is not constricted.

Geographical Range.

Reid River, near Townsville, Queensland. (R. H. Cambage.)

TALLOW-WOODS.

These particular woods are in a class by themselves, and are easy of determination by their colour and greasy nature.

Species Illustrated in Colour:

E. microcorys, F.v.M. (Tallow-Wood).

*Eucalyptus microcorys, F.v.M.

"TALLOW-WOOD." Plate 53 and Bark Plate 53A.

TIMBER.

Description and Uses.

A splendid forest tree, having a flatish bark of a somewhat fibrous character. It is a greyish-yellow colour, hard, fairly close-grained timber, and of a greasy nature. The timber is used extensively for flooring, window sills, wood blocks, bridge work, sleepers, heavy coach and waggon construction, wheelwrights' work, or for any purposes requiring a strong durable timber. One of the finest of our hardwoods.

H. = Hard. W. = 59 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

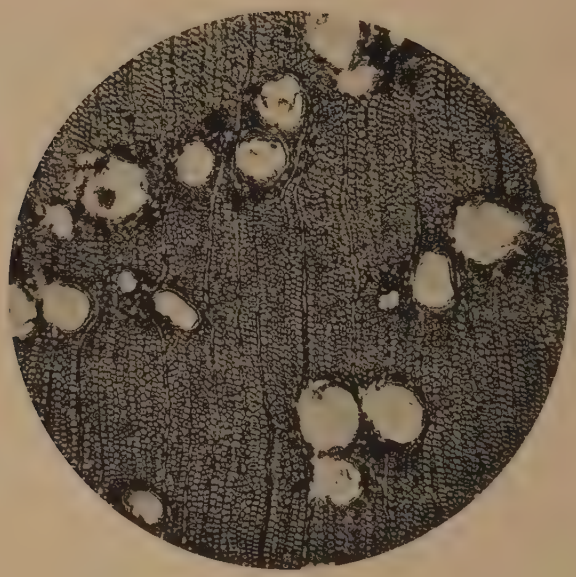
(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	6,500	6,000	8,000
Modulus of rupture in lb. per square inch ...	13,310	12,385	16,210
„ elasticity „ „ ...	2,430,000	2,803,846	3,294,117
Rate of load in lb. per minute	722	644	800

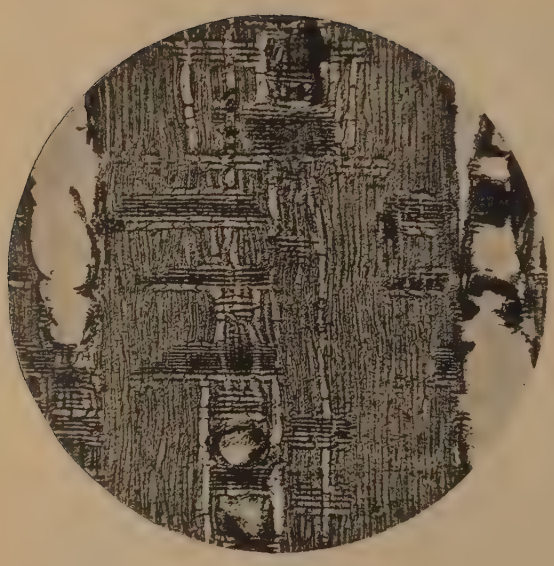
Anatomical Features.

A fairly close-textured timber, the fibres being thick-walled, leaving a small lumen, and closely packed, the perforations being very numerous and bordered, running longitudinally. The wood parenchyma is not numerous, but mostly clustered around the pores, a few containing a brown secretion; the rays are fairly numerous, almost invariably one cell wide and only a few high, the cells mostly empty. The vessels are fairly well distributed, but contain no secretionary substance, the walls being thickly studded with pits. A few tracheids were detected.

FIG. XLVI.



CROSS SECTION, showing pores of varying sizes and fibres in regular radial rows; extending below the centre is a band of late wood.



Micro. photo.]

RADIAL SECTION, showing numerous fine rays; sections of vessels and regular disposition of fibres.

[*T. C. Roughley*

TANGENTIAL SECTION, showing longitudinal section of vessels plugged with tyloses. Most of the rays show a deposit in the cells.

EUCALYPTUS MICROCORYS, F.v.M.

PLATE 53.

TALLOW-WOOD.
(*Eucalyptus microcorys*, F.v M.)

PLATE 54.

BROWN STRINGYBARK.
(*Eucalyptus capitellata*, SM.)

PLATE 53A.

TALLOW-WOOD BARK.

(*Eucalyptus microcorys*, F.v.M.)

Systematic.

A well marked and distinct species, characterised chiefly by its pale-coloured, hard, durable, greasy-natured timber. It appears to be always known vernacularly as "Tallow-wood," and is never confounded by settlers and timber-getters with any other species. The fruits and leaves have a great resemblance to those of *E. ochrophloia* of the north-west of New South Wales. A tall tree with a pale-coloured fibrous bark; branchlets quadrangular. Abnormal leaves ovate, about 3 inches long, acuminate, membraneous, pale on the under surface; venation distinct, lateral veins very spreading; intramarginal vein removed from the edge. Normal leaves lanceolate, varying in length up to 6 inches or longer, rather thicker than the sucker leaves, pale on the under side; venation distinct, lateral veins spreading, intramarginal one removed from the edge. Peduncles axillary, or in short terminal panicles or corymbs, flattened; generally about six flowers in the head. Calyx small, pedicel slender, 4 to 6 lines long. Operculum small domed. Fruit about 6 lines long, conical, elongated, largely cylindrical, sometimes angular at the base, about 3 lines in diameter; double rimmed valves slightly exserted.

Geographical Range.

North Coast district of New South Wales and into Queensland

Eucalyptus Planchoniana, F.v.M.

"TALLOW-WOOD."

TIMBER.

DESCRIPTION AND USES.

This is not a well-known tree, but nevertheless it produces an excellent timber, and so is worthy of afforestation. The wood is pale yellow in colour, hard and straight grained, and very similar to *E. pilularis* (Blackbutt) in both colour and texture, but is probably called a Tallow-wood by the similarity of its bark with *E. microcorys*. The timber could be used for general construction purposes, coach and wheelwrights' work, wood blocks, shipbuilding, &c.

H. = Very hard. W. = 61 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	9 580	9,980
Modulus of rupture in lb. per square inch ...	19,160	20,997
,, elasticity ,, ,, ...	2,482,700	2 953 800
Rate of load in lb. per minute	1,064	998

Systematic.

A tall tree with a fibrous bark, much resembling *E. microcorys*. Abnormal leaves large, sometimes 1 foot long and 2 inches broad, lanceolate, drying almost "khaki" colour; venation distinct, spreading, marginal vein removed from the edge. Normal leaves of mature trees rigid, lanceolate, falcate pale-coloured; venation similar to that of the abnormal leaves. Branchlets distinctly quadrangular, almost winged. Peduncles axillary, much flattened, nearly ¼ inch broad, with four to six flowers. Calyx ribbed, tapering downwards to a short, thick pedicel, 4 lines in diameter. Operculum ribbed, conical, obtuse, under 6 lines long. Fruit large, almost ¾ inch long and ¾ inch in diameter, contracted towards the narrow or countersunk rim; valves deeply sunk.

Geographical Range.

Woodburn, Evans' River, New South Wales and Queensland.

STRINGYBARKS.

A VERY widely distributed class of Eucalypts, being only absent from the interior of the Continent. The timber is fairly uniform in texture and colour, so that great care is required in specifically naming some of these hardwoods, the colour not helping much, the texture being the main feature of each species.

A fresh-planed surface (with the exception of Red Stringybark and Brown Stringybark) has a colour a shade or two darker than Ash. It is pale, with just a tinge of the very palest brownish-yellow. The two exceptions are inclined to the reddish-brown hue.

SPECIES ILLUSTRATED IN COLOUR:

E. capitellata, Sm. (Brown Stringybark).
E. dextropinea, R.T.B. (A Stringybark).
E. eugenioides, Sieb. (White Stringybark).
E. fastigata, H.D. and J.H.M. (Stringybark).
E. lævopinea, R.T.B. (Silver-top Stringybark).
E. macrorhyncha, F.v.M. (Red Stringybark).
E. Muelleriana, A.W.H. (Yellow Stringybark).
E. obliqua, L'Herit (A Stringybark).

Eucalyptus Baileyana, F.v.M.

"ROUGH STRINGYBARK."

TIMBER.

DESCRIPTION AND USES.

One of the best of the Stringybarks, having a light-grey, very tough timber. Suitable for house building, posts, fencing, carriage work, tool handles, and other purposes where toughness is required.

Systematic.

A tall tree, rising sometimes to a height of 150 feet. Bark fibrous and persistent on the branches as well as on the stems. The tree should be easy of determination from the other stringybarks, as the fruits are quite specific, being rather large, globular, urn-shaped, three-celled, margin of the orifice thinly compressed. Found mostly on poor sandy ridges.

Geographical Range.

The North-east corner of New South Wales and South-east Coast district of Queensland.

Eucalyptus campanulata, R.T.B. et H.G.S.

A "STRINGYBARK."

TIMBER.

Description and Uses.

A superior timber-yielding Stringybark and one of prospective forestry and commercial importance when better known. The timber is pale-coloured, close grained, hard, strong, and suitable for carriage work, general building purposes, posts, rails, sleepers, and even cabinet work.

H. = Hard. W. = 52 lb. per cubic foot.

TRANSVERSE TEST OF TIMBER.

(The following was made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.
Breaking load in lb.	6,585
Modulus of rupture in lb. per square inch ...	13,347
,, elasticity ,, ,, ...	2,070,646
Rate of load in lb. per minute	506

Systematic.

An average forest tree with smooth branches. Abnormal leaves comparatively small, lanceolate, oblique, sub-coriaceous, not shining. Venation not at all well marked on the smaller upper leaves, but distinctly in the others. Lateral veins very oblique. Abnormal leaves broadly lanceolate, oblique, shining, same colour on both sides, often over 9 inches long; venation well marked; lateral veins oblique, distant, intramarginal vein well removed from the edge. Fruits at the earliest stage of development campanulate on a slender pedicel; mature fruits pyriform, rim truncate, or slightly countersunk, about ½ inch diameter at the rim.

Geographical Range.

Coast Range from Ulladulla to Queensland border and probably into that State.

*Eucalyptus capitellata, Sm.

"BROWN STRINGYBARK." Plate 54.

TIMBER.

Description and Uses.

Although not one of the best of this group of trees, yet it is of forestry consideration, as it favours rather poor soil, and so could be planted on sandy and rocky ridges and mountains. The timber is pale-brown coloured, hard, good working; suitable for house building and purposes to which ordinary hardwoods are used, such as fencing, &c. In regard to durability this Stringybark timber, although good, may be ranked as inferior to that of White Stringybark, *E. eugenioides*, Sieb., but superior to the Red Stringybark, *E. macrorhyncha*, F.v.M. This species is fairly plentiful throughout the south-east of the Continent.

H. = Hard. W. = 62 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	10,180	7,130
Modulus of rupture in lb. per square inch ...	20,360	14,260
,, elasticity ,, ,, ...	2,400,000	2,117,600
Rate of load in lb. per minute	1,018	1,188

Systematic.

A large tree, bark fibrous, stringy, brownish. Abnormal leaves lanceolate, straight, pale-coloured; venation fine, oblique, parallel, distant: intramarginal vein removed from the edge, which is sometimes crenulate. Leaves shining, 3 to 6 inches long, oblique, lanceolate, falcate; venation faintly marked, transverse veins oblique, parallel, distant: intramarginal vein removed from the edge. Peduncles axillary, with six to twelve sessile flowers. Calyx thick, with almost parallel sides, about 4 lines long, and 2 lines in diameter. Operculum hemispherical, obtuse. Fruit compressed, globose, under ½ inch diameter, rim domed, valves exserted.

Geographical Range.

Coast district and Dividing Range, Queensland, New South Wales, Victoria, and South Australia.

Eucalyptus carnea, R.T.B.

"STRINGYBARK."

TIMBER.

Description and Uses.

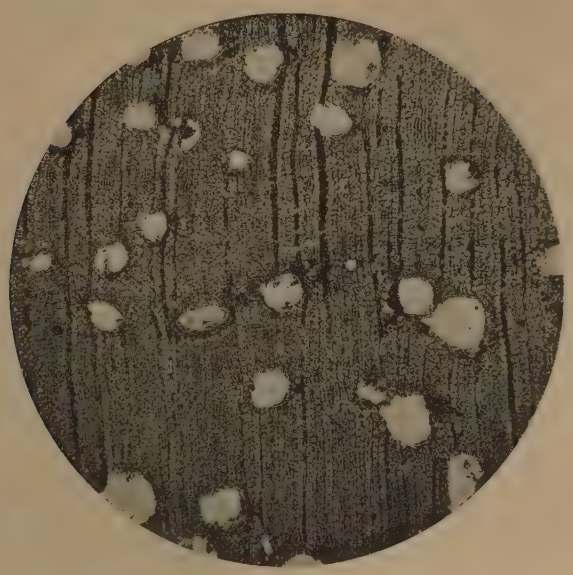
A rather rare species found in the Northern Coast districts of New South Wales. The timber is a light flesh colour, and occasionally develops gum veins, but it is a hard, close-grained timber, and one of the best of the Stringybarks, and quite equal in qualities to *E. eugenioides* (White Stringybark) and could be used for similar purposes to which the latter is employed.

H. = Hard. W. = 62 lb. per cubic foot.

Anatomical Features.

An even-textured wood with rather large fibres with medium thickness of walls and a comparatively large lumen, free from colour contents. The pores are fairly numerous, as well as the rays, and scattered throughout the wood material; the fibre perforations are ovate and numerous. The vessels are rather free from tyloses, and the partition cell walls are not numerous, and tracheids were noted. The wood parenchyma is above the average in amount, and generally clustered around the vessels. The rays are of the homogeneous kind, and have only a low percentage of cells filled with colour content.

FIG. XLVII.



CROSS SECTION, showing how compact the fibres are in this timber; pores of varying diameters.

Micro. photo.]

RADIAL SECTION, showing dark coloured deposit in the cells of the rays; and portions of vessels amongst the fibres.

[*T. C. Roughley.*

TANGENTIAL SECTION, showing small rays amongst the fibres; a vessel on the right centre of plate is also seen.

EUCALYPTUS CARNEA, R.T.B.

Systematic.

A tall tree, attaining sometimes a height of 100 feet, with a dark-coloured stringybark, which runs right out to the branchlets. Abnormal leaves opposite, sessile, cordate, ovate, acuminate, thin, pale-coloured on the underside, where the venation is more pronounced, upper surface shining, over 3 inches broad and sometimes 6 inches long. Leaves lanceolate-falcate, varying in length up to 8 or 9 inches, and in breadth from under 1 inch up to nearly 3 inches, and often very oblique at the base (the larger leaves especially so), coriaceous, pale-coloured on both sides; the intramarginal vein is well removed from the edge, and the lateral ones are distinct, oblique, and spreading. Inflorescence occurs mostly in terminal panicles, but occasionally in axillary peduncles. Calyx turbinate, gradually tapering into the flattened pedicel. Operculum hemispherical, shortly acuminate.

Geographical Range.

The Northern Coast brushes of New South Wales and South Queensland. (C. T. White.)

Eucalyptus dextropinea, R.T.B.

"STRINGYBARK." Plate 55.

TIMBER.

Description and Uses.

A typical forest Stringybark tree, having a light brownish, fairly hard, close, straight-grained timber, and used for house building in the localities where it occurs. It is an average timber suitable for many purposes where hardness and durability are a desiderata.

H. = Hard. W. = 54 lb. per cubic foot.

Anatomical Features.

The fibres are a very pronounced feature, and form by far the larger portion of the wood structure, the walls are of a uniform thickness throughout; the lumen, which is rather small for a Stringybark, is quite free of any secretionary deposit, as also are the pores. The wood parenchyma is quite limited, in fact, might almost be said to be rare, as also is the occurrence of tyloses in the vessels. The rays are fine and numerous.

Systematic.

A tree attaining a height of from 60 to 100 feet or higher, and a diameter up to 5 feet. Bark dark or black on the outside, fibrous and longer in the fibre than that of *E. lævopinea*. Branches smooth for a considerable distance down, but this feature varies. Leaves almost identical with *E. lævopinea*, and resembling also those of *E. obliqua*, L'Her. Abnormal leaves broad, rounded at the base and very acuminate, opposite or nearly so, on a short petiole, the venation well defined, the intramarginal vein being much removed from the edge. Normal leaves lanceolate, falcate, acuminate, often very oblique, shining on both sides, rather thick, the intramarginal vein removed from the edge. Umbels axillary with about eight flowers, peduncle flattened. Calyx-tube obconical, stalklet 4 to 6 lines long. Buds longer and larger than those of *E. lævopinea*, R.T.B. Operculum hemispherical, shortly acuminate. Fruits 4 to 6 lines in diameter, hemispherical, truncate or rounded, occasionally domed, rarely countersunk, valves slightly exserted.

Geographical Range.

New South Wales, Wingello, Barber's Creek, Currawang.

PLATE 55.

A STRINGYBARK.

(*Eucalyptus dextropinea*, R.T.B.)

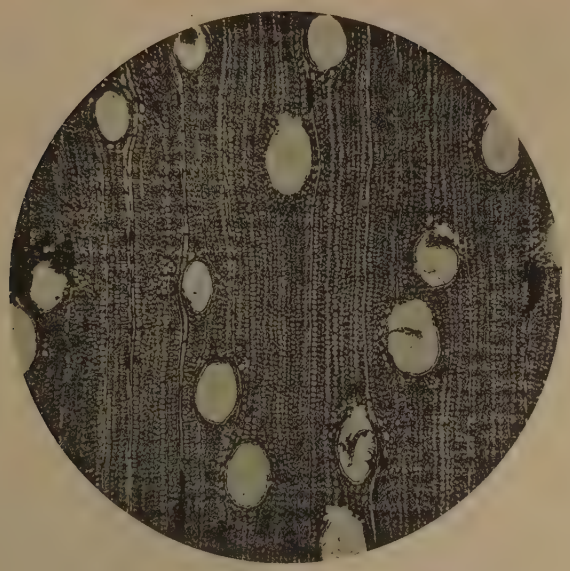
The dark brown on left is not bark, but foreshortening of Cambium area.

PLATE 56.

WHITE STRINGYBARK.

(*Eucalyptus eugenioides*, SIEB.)

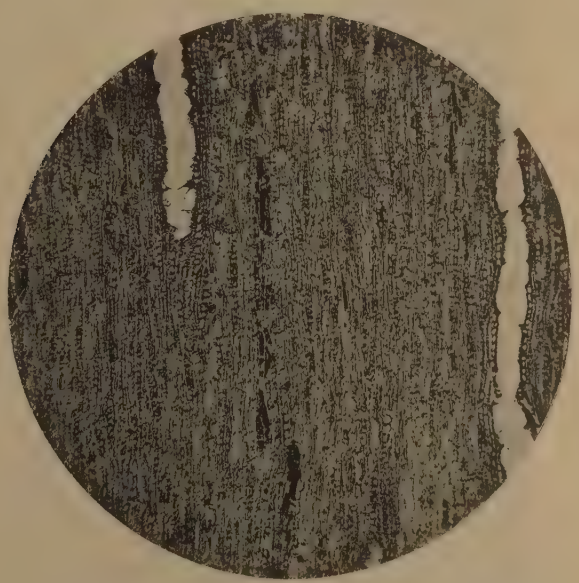
FIG. XLVIII.



CROSS SECTION, showing clear pores, rays, and wood parenchyma; the fibres being particularly regular in arrangement and size.

Micro. photo.]

RADIAL SECTION, showing mostly fibres and several rays, with portions of three vessels.



[*T. C. Roughley.*

TANGENTIAL SECTION, rays and fibres are not too clearly defined; portions of two vessels are seen.

EUCALYPTUS DEXTROPINEA, R.T.B.

*Eucalyptus eugenioides, Sieb.

"WHITE STRINGYBARK." Plate 56, Bark Plate 56A.

TIMBER.

Description and Uses.

A widely distributed species along the coastal area and ranges of the East Coast, and one which has a great reputation for durability, being regarded as one of the best of the Stringybarks, which it undoubtedly is. The wood is hard, fissile, pale-coloured, works and dresses well, and is a splendid timber for house building and wood structures of all kinds, such as churches, schools, halls, railway waggons, wood blocks, shipbuilding, sleepers, telegraph poles. In the ground it is most durable, and posts made from this species are said to be sound after being in the ground over 50 years. It is also one of the finest timbers for wood-carving. (See under Carving, Part III.)

H. = Hard. W. = 55 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	9,640	10,170	7,610
Modulus of rupture in lb. per square inch ...	19,409	20,340	15,425
„ elasticity „ „ ...	2,635,900	2,482,700	2,211,600
Rate of load in lb. per minute	1,205	1,017	1,087

Anatomical Features.

A compact timber, the fibres of varying diameters, and not arranged in any regular rows, with numerous perforations, the lumen in some cases containing a deposit; vessels compressed at the late growth, mostly with tyloses and sometimes a deposit.

The distinguishing feature is the almost entire absence of wood parenchyma; the rays are numerous in proportion, mostly of the uniseriate variety, and a few cells high; a deposit was found in the cells.

Systematic.

A tall tree, bark thick, stringy, of a clean reddish colour or hoary on the external fibres. Abnormal leaves ovate, lanceolate, with crenulate edges, scabrous, oblique, acuminate on a petiole of about ¼ inch long; venation fine, lateral veins oblique, parallel; intramarginal vein removed from the edge. Normal leaves falcate, lanceolate, oblique, medium size, often shining, venation similar to that of abnormal leaves. Peduncles axillary, very numerous at the base of the branchlets, compressed, with many flowers. Calyx 2 to 3 lines long, tapering into the short pedicel. Operculum conical, obtuse, about as long as the calyx. Fruits compressed, small, pitular; rim red, broad, sloping outwards; valves not exserted.

Geographical Range.

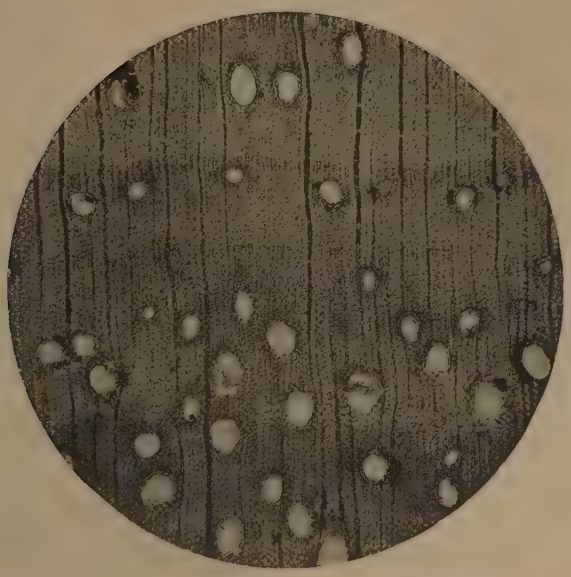
The coast and tablelands of Victoria, New South Wales, and Queensland.

PLATE 56A.

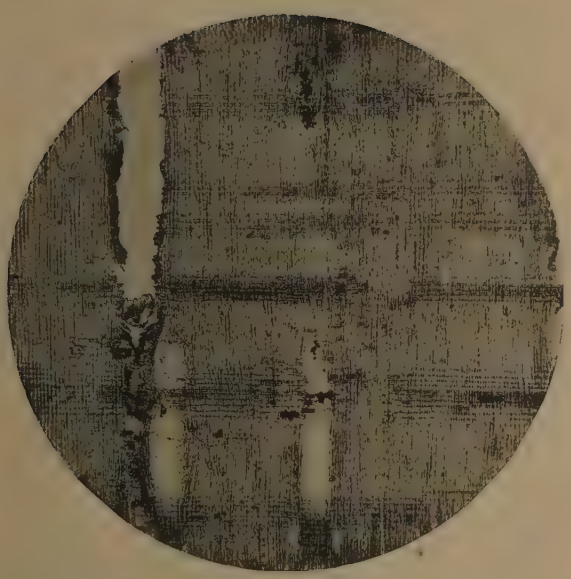
WHITE STRINGYBARK.

(*Eucalyptus eugenioides*, SIEB.)

FIG. XLIX.



CROSS SECTION, showing fine, even texture of the wood and radial disposition of the fibres, and rather small pores. The thick fibres in lower portion mark the late wood.



Micro. photo.]

RADIAL SECTION, cut through several rays. Portions of three vessels are also seen.

[*T. C. Roughley.*

TANGENTIAL SECTION. The smallness of the rays are a feature of this wood.

EUCALYPTUS EUGENIOIDES, SM.

Eucalyptus Guilfoylei, J.H.M.

"STRINGYBARK."

TIMBER.

DESCRIPTION AND USES.

The timber is good and durable, splits well, and is used largely for palings and fencing, should make good railway sleepers, and also useful for house building purposes. It is entirely different from the Karri. (J.H.M.)

Systematic.

A tall tree with fibrous or stringybark to within a few feet of the branches Abnormal leaves thin, glabrous, paler on the lower sides, petiolate, ovate-acuminate, about twice as long as broad, midrib prominent, lateral veins nearly parallel, making an angle of about 35 degrees with the midrib; very fine intramarginal vein not conspicuous and not far removed from the leaf margin. Normal leaves coriaceous, broadly lanceolate, up to 6 inches long, and more commonly a quarter of that wide in the widest part, numerous fine lateral parallel veins, making an angle of about 30 degrees with the midrib, marginal veins close to the edge. Flowers in a compound panicle, peduncles very angular. Buds in umbels up to seven in the bud on a long flat peduncle, nearly sessile, the angular calyces tapering into the very short pedicels. Operculum nearly hemispherical, and less than half the length of the calyx. Fruits truncate, pear-shaped, with a marked angle and frequently a second one diametrically opposite to it, barely 1 cm. long and slightly less in greatest diameter. Rim countersunk, three to four valved, with the points of the valves completely not exserted.

Geographical Range.

Denmark, West Australia.

Eucalyptus fastigata, H.D. et J.H.M.

"STRINGYBARK." Plate 57.

TIMBER.

DESCRIPTION AND USES.

A very distinct timber, and one that is valued in some parts for its durability in the ground. The timber is straight-grained, pale-coloured, and free-working, fissile, and not unlike *E. regnans* and *E. Delegatensis* in this respect.

It is a good substitute for imported Ash (*Fraxinus*), and suitable for all technical applications, where that timber is used. It has so far only been used locally, but is a tree worthy of forestry consideration, for it is an excellent medium hardwood.

H. = Moderately hard. W. = 56 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb, ...	8,880	9,320	8,280
Modulus of rupture in lb. per square inch ...	17,760	18,640	16,560
„ elasticity „ „ ...	2,769,000	2,880,000	2,823,530
Rate of load in lb. per minute	1,100	1,035	1,035

PLATE 57.

STRINGYBARK.

(*Eucalyptus fastigata*, H.D. ET J.H.M.)

PLATE 58.

SILVER-TOP STRINGYBARK.

(*Eucalyptus lævopinea*, R.T.B.)

Systematic.

A tall tree, the bark of which resembles closely that of *E. obliqua*, the principal difference between the two trees in this respect consisting in the fact that the tops and the branches are smooth, while those of *E. obliqua* are the reverse. Abnormal leaves ovate-lanceolate, the veining of the under side prominent; the twigs rusty, tuberculate, like *E. amygdalina* and some other species. Leaves of mature trees lanceolate, and, when fully grown, narrow lanceolate; often more or less ovate-lanceolate, and always more or less attenuate. They are rather chartaceous, smooth, and shining. The chief characteristic of the buds is the shortly acuminate operculum, which is much accentuated in dried specimens. Fruit pear-shaped, conical, rim domed, with the valves somewhat exserted, diameter 2½ to nearly 3 lines. The fruit differs from that of *E. obliqua* in being more or less conical, while that of *E. obliqua* is subcylindrical.

Geographical Range.

Coast districts of New South Wales, and Eastern Victoria.

Eucalyptus lævopinea, R.T.B.

"SILVERTOP STRINGYBARK." Plate 58.

TIMBER.

DESCRIPTION AND USES.

A hard, close-grained, interlocked, pale coloured timber, difficult to distinguish from *E. pilularis*, Blackbutt, but yet a harder and superior timber. It is durable in the ground and free from gum veins as a rule. Suitable for bridge decking, wood blocking, posts, rails, and general building purposes requiring a hard, durable wood. It is a very desirable timber in constructional works of all kinds, house building, heavy carriage works, and many other branches of industry. One of the best trees for forestry afforestation on basalt ridges, as it is restricted to these in its natural habitat.

H. = Hard. W. = 50 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	5,750	4,750	5,050
Modulus of rupture in lb. per square inch ...	11,199	9,312	9,900
,, elasticity ,, ,, ...	1,383,902	1,270,590	1,246,428
Rate of load in lb. per minute	638	678	505

Systematic.

A very tall tree in favourable situations. Bark fibrous but brittle, a feature that distinguishes it from that of Red Stringybark, *E. macrorhyncha*, F.v.M. and White Stringybark, *E. eugenioides*, Sieb.; ultimate branches smooth. Abnormal leaves alternate or scarcely opposite, broad at the base but not cordate, acuminate, about 3 inches long; the intramarginal vein removed from the edge, the lateral ones very distinct on the underside, scarcely showing on the upper surface. Leaves mostly very oblique, of a dark green colour and shining on both sides, lanceolate, falcate, acuminate, the intramarginal vein removed from the edge, lateral veins fairly distinct. Umbels axillary bearing about five to seven flowers, lid hemispherical, shortly acuminate, calyx not angular. Fruits hemispherical, petiolate; the rim variable, at first thick and flat or truncate, and then as it matures gradually becomes exserted and eventually domed.

It is invariably found growing on basalt ridges, and this location at once separates it from *E. macrorhyncha*, which grows on the surrounding sandstone and country in the district from which it was first described.

Geographical Range.

So far it has only been recorded from the Rylstone district, but probably has a much wider range on the Northern ridges.

*Eucalyptus macrorhyncha, F.v.M.

"RED STRINGYBARK. Plate 59.

TIMBER.

DESCRIPTION AND USES.

This is one of the widest distributed Stringybarks of the Eastern States, occurring mostly in sandstone ridges. It grows to a fair-sized tree, and has a pale reddish-coloured timber, not highly valued, being inferior in durability to either the White or Brown Stringybark. It planes well, is fairly hard, close grained, fissile, and could be used for general purposes when better hardwoods are not available.

H. = Moderate. W. = 51 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	6,340	6,160	5,610
Modulus of rupture in lb. per square inch ...	12,980	12,654	11,651
,, elasticity ,, ,, ...	.....	.....	.....
Rate of load in lb. per minute	452	684	623

Systematic.

A tall tree. Bark compact, coarse, stringy, blackish on the outer surface. Abnormal leaves ovate to lanceolate, falcate, shortly acuminate, about 6 inches long and 2 inches broad; venation well marked, lateral veins few, spreading, intramarginal vein removed from the edge. Normal leaves of mature trees oblique, lanceolate, or ovate lanceolate, generally under 6 inches long, slightly shining; venation distinct, lateral veins oblique, few, spreading; in the broader leaves the intramarginal vein is well removed from the edge. Peduncles axillary, up to 1 inch long, flattened, bearing about half a dozen flowers. Calyx angular, often ¼ inch long, including the pedicel. Operculum of two forms, conical, with a sharp constriction above the calyx rim, 3 lines long; fruit hemispherical, up to 3 lines in diameter, rim strongly domed.

The fruit of *E. macrorhyncha* is so characteristic, that the species is very rarely, if ever, confounded with any other Eucalyptus.

Geographical Range.

The Rylstone district to Victorian border, North near Tenterfield, and, in fact, all Eastern States.

Eucalyptus Cannoni. Sp. nov.

"RED STRINGYBARK."

TIMBER.

DESCRIPTION AND USES.

A timber easily differentiated from any other of the group of red stringybarks on account of its reddish-brown colour. It is shorter in the grain than that of *E. macrorhyncha*, with which it has been confounded in the past, and lasts longer in the ground, and does not turn so freely as that species (G. Harris).

PLATE 59.

RED STRINGYBARK.
(*Eucalyptus macrorhyncha*, F.v.M.)

PLATE 60.

YELLOW STRINGYBARK (VICTORIA).
(*Eucalyptus Muelleriana*, A.W H.)

It is a more open, and straighter-grained timber than any in the group in which it is placed, and more closely approaches *E. obliqua* in texture than *E. macrorhyncha*, but is far heavier than that wood.

It planes easily, and could be used for general economic purposes, such as parts of carriages, furniture, picture frames, tool handles, weatherboards, &c.

H. = Moderate. W. = 59½ lb. per cubic foot.

REMARKS.

This tree was found by me in the locality quoted in 1892, and was considered then as a variety of *E. macrorhyncha*, but fresh data having been brought to light by Mr. G. Harris it was further investigated, with the result that the new features were found sufficient to warrant its being raised to specific rank. It differs from its congener, *E. macrorhyma*, in the shape of its fruit, buds, inflorescence, timber and bark. *E. macrorhyncha* extends over a wide geographical range, occurring in New South Wales, Victoria, and South Australia, and is constant throughout in its morphological characters, and in spite of the various climates and soils it does not produce any change of specific features approaching those of these species. It is only found on basaltic mountain ridges in the Ilford and Rylstone districts of New South Wales. Ecological field characters readily differentiate it from its congener, *E. macrorhyncha*. It is named after Mr. D. Cannon, Herbarium Assistant.

Systematic.

An average forest tree with a typical "Stringybark," abnormal leaves ovate to broadly lanceolate, up to 5 inches long, acuminate, recurved at the tip, shining, petiolate, venation well marked, oblique, prominent veins distant, intramarginal veins well removed from the edge, oil glands very numerous, normal leaves oblique, with mostly parallel edges, with a pronounced acuminative, coriaceous venation strongly marked, lateral veins oblique, distant marginal vein removed from the edge, spotted by insect punctures, as in *E. Camphora*, R.T.B.

Inflorescence axillary, about six flowers in the umbel on a peduncle about 1 inch long; buds rather large, calyx and pedicel quadrangular, operculum strongly acuminate; stamens red, anthers renantherous.

Fruits large, over ½ inch in diameter, rim pronouncedly domed, valves exserted, edge of capsule conspicuously broadly flanged. Illustrated in "Eucalypts and their Essential Oils," Baker and Smith, under *E. macrorhyncha*. Fruits shown under Fig. 5 of that work.

Geographical Range.

Basaltic hills in the neighbourhood of Ilford, Mudgee Line (G. Harris, "Woodlands").

*Eucalyptus Muelleriana, A.W.Howitt.

"YELLOW STRINGYBARK." Plate 60.

TIMBER.

DESCRIPTION AND USES.

A pale yellowish-brown timber, similar in colour and texture to *E. pilularis*, Blackbutt. It is a free-working timber, and has a great reputation for durability in the ground. It should be suitable for house building, bridge work, wood blocks, coach and carriage work, fencing

posts, and rails, sleepers, shipbuilding, and for many other branches of the timber trade. It is sometimes confounded with *E. dextropinea*, but is superior to the timber of that species.

H. = Hard. W. = 61 lb. per cubic foot.

Systematic.

This tree appears to grow to the largest size on sands and sand clays of South Gippsland, where it forms most valuable forests. Its maximum height is 170 feet or thereabouts, but more frequently 100 feet to 150 feet. The bole is straight and rather massive, with moderately spreading branches, and a fibrous and dark grey bark. The bark is persistent up to the small boughs, which are more or less smooth. The leaves are lanceolate, falcate, and more or less unequal, shining on both sides. The flowers are usually solitary, and there is a marked tendency in this Eucalypt for them to become strongly paniculated. The buds are from three to twelve in most of the umbels. The lid semi-ovate to hemispheric, smooth and occasionally slightly pointed. Fruit almost hemispherical to approaching semi-ovate, the rim flat or even slightly inverted, not wide, valves deltoid, small, and inserted, or more rarely slightly prominent; four valved, less frequently three to five valved.

Geographical Range.

The western half of Gippsland, Victoria.

*Eucalyptus obliqua, L'Her.

"A STRINGYBARK." Plates 61 and 62.

TIMBER.

Description and Uses.

This is one of the best known of our Stringybarks, and is a commercial timber extensively used in various directions in the building trade. It is fissile, fairly hard, rather open-grained, and of medium weight, of a pale-brown colour, but in young trees almost white, and easy working. Hobart-town palings, so largely exported from Tasmania a few years ago, were split from timber of this tree. It is one of the few Eucalypts that carries a sapwood prone to borers, and so care must be taken to remove this before utilisation, as that portion is soon riddled by these destructive insects. It is a fairly strong, tough, good, all-round timber, and is used extensively in Tasmania for joinery, furniture, internal fittings, and cabinet work—in this connection it is sold under the name of Tasmanian Oak, along with *E. Delegatensis*, the colour closely resembling Oak (*Quercus*) wood. It is a very good carving timber, much resembling English Oak in this respect.

H. = Hard. W. = 46 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	5,850	6,600	6,510
Modulus of rupture in lb. per square inch ...	12,187	13,750	13,166
,, elasticity ,, ,, ...	2,650,909	3,836,842	3,029,610
Rate of load in lb. per minute	731	733	813

PLATE 61.

A STRINGYBARK.
(*Eucalyptus obliqua*, L'HER.)

PLATE 62.

A STRINGYBARK.
(*Eucalyptus obliqua*, L'HER.)

Systematic.

This tree was the first Eucalyptus made known to science, and it was on this species that the genus was founded by L'Héritier. The original specimens came from Tasmania, but it occurs over extensive areas in Victoria, Tasmania, and in the New South Wales Coast Ranges. Its botanical and chemical characters are constant throughout this extensive range. It derives its specific name from the unequal halves of its leaves; but this is not a good specific character, as several other Eucalypts have this particular feature well marked.

It is one of our largest forest trees, with a stringybark right out to the branchlets. Leaves lanceolate, oblique, varying in size up to 7 inches long and 2 or 3 inches wide. Venation distinct, lateral veins oblique, forming an acute angle with midrib. Buds numerous, in lateral peduncles, tapering into the peduncles, operculum domed. Fruits oval, up to ½ inch long and ¼ inch broad, rim countersunk.

Geographical Range.

On the Coast Range from Queensland to South Australia, over Tasmania, except the highlands.

Eucalyptus Stuartiana, F.v.M.

"APPLE OF VICTORIA."

TIMBER.

DESCRIPTION AND USES.

A hard, red wood of not much economic value, but is a well-known firewood of Victoria. It is quite a distinct timber from that of *E. Bridgesiana*.

Systematic.

A large tree, with a red stringybark, glaucous, terete branchlets, and glaucous inflorescence. Abnormal leaves glaucous, ovate, acuminate, cordate, sessile, opposite, rarely lanceolate; variable in size, the larger ones 6 inches long and 4 inches wide, and having a very pronounced venation; the marginal vein being well removed from the edge; the smaller leaves are much finer in texture. Normal leaves lanceolate, generally under 6 inches long, and varying in breadth, occasionally opposite, same colour on both sides; venation distinct, lateral veins oblique, spreading, intramarginal one slightly removed from the edge. Peduncles axillary, flattened, about 3 lines long, with generally seven or more almost sessile flowers in the head. Calyx conical, under 2 lines in diameter. Operculum conical, acute, slightly depressed below the apex, or hemispherical and acuminate. Fruit turbinate or conical, about 3 lines in diameter, occasionally angular at the base; rim thick. Valves exserted, sometimes prominently so, when they are then acute.

Geographical Range.

Victoria.

Eucalyptus Jacksoni, J.H.M.

"STRINGYBARK."

TIMBER.

DESCRIPTION AND USES.

"Timber a bright red, reminding one, in that respect, of the Forest Mahogany of New South Wales (*E. resinifera*, Sm.). It is fissile and tough, and I believe it to be a most valuable timber for economic purposes." (J. H. Maiden.)

Systematic.

A noble forest tree up to 200 feet high, erect in habit, with a long trunk, and a diameter up to 15 feet; known locally as "Red Tingle Tingle." Bark fibrous, reddish, thick, of a stringybark character, but somewhat brittle, covering the trunk and branches. Abnormal leaves nearly orbicular to broadly lanceolate, somewhat oblique; venation distinct but fine, lateral veins nearly parallel, intramarginal vein well removed from the edge. Normal leaves petiolate, broadly lanceolate, acuminate, veins not very conspicuous, lateral veins parallel, intramarginal vein well removed from the edge. Buds and flowers not known. Fruits almost spherical, sunk below the orifice.

Geographical Range.

South-west Australia.

Eucalyptus Wilkinsoniana. R.T.B.

"SMALL-LEAVED STRINGYBARK."

TIMBER.

DESCRIPTION AND USES.

This is not one of the largest trees of the forest, but rather below the average in height. The bark is of a reddish nature, quite unlike the type of the group. The timber is pale-coloured, hard, close grained, fairly heavy. In transverse and compression tests it ranks high amongst the Stringybarks here enumerated. It is evidently an excellent hardwood, and is strongly recommended for forest conservation, and when better known, will be much appreciated in the various timber trades.

H. = Hard. W. = 55 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timbers of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	9,690	9,620
Modulus of rupture in lb. per square inch ...	19,380	19,240
„ elasticity „ „ ...	2,526,400	2,571,400
Rate of load in lb. per minute	1,211	1,202

Systematic.

A medium sized tree with a thin compressed, not furrowed, stringy bark. Abnormal leaves lanceolate, falcate, generally under 3 inches long and under 6 lines wide, oblique, thin; venation oblique, parallel, distant; intramarginal vein removed from the edge. Leaves uniform throughout, only larger than the abnormal. Flowers on axillary peduncles of about 6 lines long. Calyx small, 1 line long. Operculum small, hemispherical, acuminate. Outer stamens apparently sterile; anthers kidney-shaped. Ovary flat-topped. Fruit hemispherical, 5 lines in diameter, rim thick, red valves slightly exserted acute.

Geographical Range.

Coast Range and district, New South Wales.

WOOLLY-BUTTS.

A term used indiscriminately to specify certain Eucalyptus trees, such as *E. Macarthuri*, *E. Bridgesiana*, *E. longifolia*. They have little in common in their timbers except that the first two are not much valued locally, but *E. longifolia* should not be so classed, for it has a red-coloured, hard, very durable, first-class timber.

SPECIES ILLUSTRATED IN COLOUR :—

E. longifolia, Link. et Otto (Woolly-butt).

*Eucalyptus longifolia, Link et Otto.

"WOOLLY-BUTT." Plate 42.

[See under Mahoganies.]

Eucalyptus Macarthuri, H.D. et J.H.M.

"CAMDEN WOOLLY-BUTT."

TIMBER.

DESCRIPTION AND USES.

Owing to better timbers prevailing where this tree occurs in its native habitat, the timber is not used, but in New Zealand, where it has been introduced, it is much appreciated, and the following, taken from the Rev. J. H. Simmonds' account of the timber in his articles on "Eucalypti cultivated in New Zealand," is of some forestry importance :—

"From an early stage in their life the trees develop a large percentage of heartwood, which is of a pale red colour, hard and strong. The logs are usually sufficiently fissile to be split with maul and wedges, but, if large, may need to be opened up with blasting powder. The one serious fault of the tree is a tendency to form large radial cracks in drying. For sawing purposes this would have to be overcome by special care in felling, milling, and seasoning. In its native country, New South

Wales, owing partly to its restricted habitat, and partly to the abundance of superior hardwoods, *E. Macarthuri* has not attracted very much attention. In our country it is certainly a tree of immense value. Long experience in the Waikato has proved that its mature heartwood will easily last twenty years in contact with the ground. For fencing-posts, culverts, and bridges, such a timber, however coarse in grain or full of cracks, meets an urgent and persistent demand."

H. = Hard. W. = 56 lb. per cubic foot.

Systematic.

A large sized tree, with a rough, somewhat "Box"-like bark. Abnormal leaves cordate, or ovate-acuminate, stem-clasping, sessile and opposite, bright green in colour, of similar tint on both sides. Normal leaves alternate, narrow, lanceolate, often falcate, thickish; venation not prominent, intramarginal vein at some distance from the edge. Buds small, the operculum and calyx of approximately equal size, the former but very slightly conical. Umbels axillary, with short scarcely flattened stalks, and stalklets absent or nearly so. Fruit small, nearly hemispherical, slightly dilated at the rim, which is well defined, valves usually three, but rarely four, scarcely exserted.

Geographical Range.

New South Wales—Mittagong, Bowral, Moss Vale; chiefly confined to the counties of Camden and Argyle.

BLACKBUTTS.

The man in the field has separated these on a cortical classification from their congeners, but in texture and colour of wood, they closely resemble most of the Stringybarks.

SPECIES ILLUSTRATED IN COLOUR:

E. pilularis, Sm. (Blackbutt).

E. patens, Benth. (Blackbutt).

*Eucalyptus pilularis, Sm.

"BLACKBUTT." Plates 63 and 64.

TIMBER.

DESCRIPTION AND USES.

This is a large forest tree with mostly a black stringy bark on the lower portion of the stem, from which it derives its common name, but occasionally it excorticates, leaving a smooth stem, so that care must be taken not to confound it with the smooth-bark Gums. It produces one of the best hardwoods on the market, being light in colour, straight grained, hard, strong, with occasionally small gum veins. Useful for constructional work, house building, especially posts, as it is very durable in the ground, wood blocks, carriage work of all kinds, ship building, wheelwrights' work, in fact, is one of Australia's best all-round hardwoods. Some tradesmen object to this wood for finished work owing to the presence of what they call a "grit." This has some foundation in fact, for my investigation disclosed silica in minute particles in the cells.

H. = Hard. W. = 59 lb. per cubic foot.

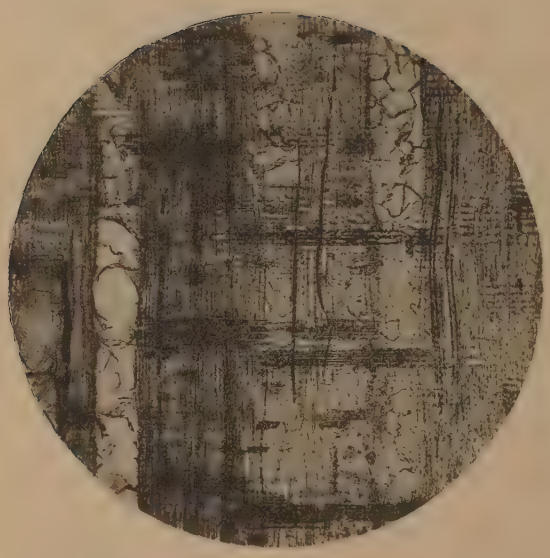
TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timbers of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	8,810	9,470	8,640
Modulus of rupture in lb. per square inch ...	17,620	19,466	17,396
„ elasticity „ „ ...	2,237,662	2,920,673	2,526,315
Rate of load in lb. per minute	881	885	1,080

FIG. L.

CROSS SECTION, showing numerous large pores and rays in wavy lines; fibres small.



Micro. photo.]

RADIAL SECTION, showing portions of three vessels plugged with tyloses; rays with deposit in cells; the black needle-shaped lines are deposits from the lumen of the fibres.

[*T. C. Roughley.*

TANGENTIAL SECTION, showing portions of two vessels; ray and wood parenchyma (right of centre).

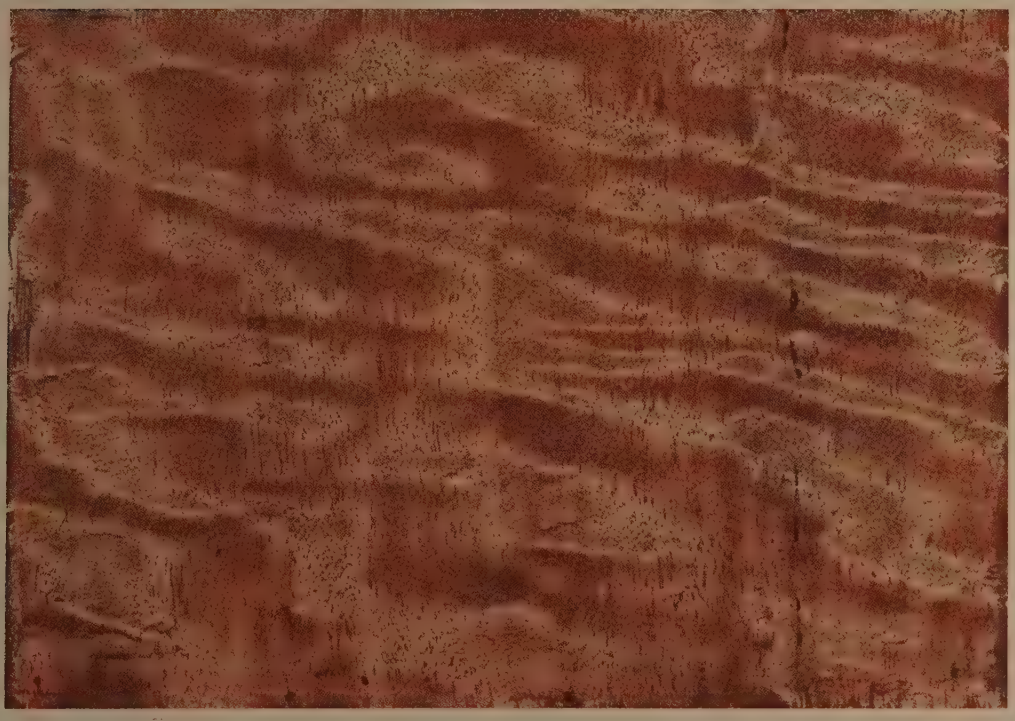
EUCALYPTUS PILULARIS, SM.

PLATE 63.

BLACKBUTT

(*Eucalyptus pilularis*, SM.)

PLATE 64.



BLACKBUTT.

(*Eucalyptus pilularis*, SM.)

ANATOMICAL FEATURES.

The fibres have only medium thick walls, leaving a fair-sized lumen which is free of any deposit. The pores are of rather a large size. Wood parenchyma rare, and rays numerous, mostly uniseriate and a few cells wide, with a deposit present in some cases. Some of the vessels were found to contain minute particles of silica.

Systematic.

One of the tallest trees of the genus. Leaves thick, shining, sometimes over 6 inches long, lanceolate, falcate, oblique, drying a very pale colour; venation indistinct, lateral veins parallel, intramarginal vein removed from the edge. Fruit semi-globose, truncate, about 5 lines in diameter, rim sometimes contracted, thin, countersunk, or broad and even domed, valves not exserted.

Geographical Range.

Coast district and tableland of New South Wales, Victoria, Queensland.

Eucalyptus Cambageana, J.H.M.

"BLACKBUTT."

TIMBER.

DESCRIPTION AND USES.

The timber is deep red or chocolate in colour, hard, heavy, long and tough in the grain, much resembling that of the Red Box (*E. polyanthemos*) of New South Wales. It is the most important timber in the Emerald district for all purposes, being sound, and yielding long clean stems of many feet, hence exceptionally suitable for milling purposes. (J. L. Boorman.)

Systematic.

A tree ranging from 50 to 80 feet high, having long pendulous branches, and a scaly bark of an Ironbark nature 3 to 4 feet from the ground, the upper stem being milky white, approaching bluish-white (glaucous). Abnormal leaves pale-coloured, equally green on both sides, rhomboid-ovate to pyriform and broadly lanceolate, petiolate, marginal vein at a considerable distance from the edge, the lateral veins spreading. Leaves lanceolate, shining, pale-coloured, venation prominent, the intramarginal vein distinctly removed from the edge, the lateral veins spreading. Flowers, umbels three to eight in the head, forming usually terminal panicles. Fruits small, conoid, the calyx-tube tapering with but slight abruptness into the pedicel, when young, with a well defined grooved rim, which almost disappears on ripening, leaving a dark brown rim, tips of the valves flush with the orifice.

Geographical Range.

Grows on a hard, clayey soil, often stony, and always some distance from water. Charters Towers, Reid River, and south of Townsville.

Eucalyptus Clelandi, J.H.M.

"BLACKBUTT."

TIMBER.

DESCRIPTION AND USES.

Timber cigar-brown, very hard. (J. H. Maiden.)

Systematic.

A tree of medium size, one of several known in Western Australia as "Blackbutt," with a bark hard-flaky or fibrous-flaky, and blackish at butt, the rest of the trunk and all branches smooth. Foliage more or less pendulous. Abnormal leaves ovate-acuminate, pedunculate, equally glaucous—green on both sides, venation not conspicuous, lateral veins feather-like, intramarginal vein hardly removed from the edge. Normal leaves narrow-lanceolate, petiolate, dull green, coriaceous, venation not conspicuous, lateral veins feather-like, intramarginal vein hardly removed from the edge. Buds with long corrugated opercula, the calyx-tube but slightly corrugated or smooth. Fruits numerous, glaucous, nearly sessile, on a common peduncle of about 1 cm. long, valves slightly exserted.

Geographical Range.

Western Australia.

*Eucalyptus patens, Benth.

"BLACKBUTT." Plate 65.

TIMBER.

DESCRIPTION AND USES.

This is one of the finest forest trees of Western Australia, attaining a height of 150 feet and up to 7 feet in diameter. The timber is pale-coloured, fairly heavy, hard, tough and durable, and useful in constructional, carriage and waggon work, sleepers, house building, wood blocks, &c., but is fast being cut out.

H. = Moderate. W. = 54 lb. per cubic foot.

Systematic.

A tree attaining a great height, with a rough, half-fibrous persistent bark. Leaves mostly falcate, from ovate-lanceolate, and under 3 inches, to lanceolate-acuminate and 4 to 6 inches long, not very thick, with fine diverging veins rather numerous, the intramarginal one more or less distant from the edge. Peduncles axillary or lateral or forming short panicles, short, terete or slightly angular, each with three to six flowers on short pedicels. Calyx-tube turbinate at the base, very broad and open above the ovary, about 3 lines diameter. Operculum hemispherical and umbonate or broadly conical, not so long as the calyx-tube. Fruit globular, truncate, nearly $\frac{1}{2}$ inch diameter, more or less contracted at the orifice, the rim narrow, the capsule sunk but not deep, flat-topped before opening, the valves not protruding.

Geographical Range.

Western Australia.

Eucalyptus Dundasi, J.H.M.

"BLACKBUTT."

This is reported to be a tall tree forming forests in the neighbourhood of Dundas, Western Australia, but no data appear to have been published concerning its timber. Its common name is "Blackbutt," a vernacular also applied in that State to *E. patens*.

PLATE 65.

WESTERN AUSTRALIAN BLACKBUTT.

(*Eucalyptus patens*, BENTH.)

PLATE 66.

RED GUM (TASMANIA).

(*Eucalyptus acervula*, HOOK.F.)

GUMS.

Those Eucalypts with a smooth bark come under this general common name, and amongst them are to be found a variety of timbers, each differing in colour, texture, durability, and weight, and whilst some of the very best are obtained from the Gums, yet, in some instances, they produce a rather inferior hardwood.

The colour is variable, and is often indicated by the common names, and for convenience of a general identification classification the timbers may be divided into Pale and Red, and, in some cases, light or dark brown.

Species Illustrated in Colour: –

Pale.

E. acervula, Hook. (Red Gum).
E. globulus, Labill. (Blue Gum).
E. goniocalyx, F.v.M. (Mountain Gum).
E. maculata, Hook. (Spotted Gum).
E. Maideni, F.v.M. (Southern Blue Gum).
E. regnans, F.v.M. (Giant Gum).
E. urnigera, Hook. (Red Gum).

Red.

E. viminalis, Labill. (Manna Gum).
E. Deanei, J.H.M. (A Blue Gum).
E. Dawsoni, R.T.B. (Slaty Gum).
E. cornuta, Labill. (Yate Gum).
E. leucoxylon, F.v.M. (Blue Gum), S.A.
E. loxophleba, Benth. (York Gum).
E. propinqua, H.D. and J.H.M. (Grey Gum).
E. punctata, DC. (Grey Gum).
E. redunca, Sch. (Wandoo).
E. salmonophloia, F.v.M. (Salmon Gum).
E. rostrata, Sch. (Murray Red Gum).
E. saligna, Sm. (Sydney Blue Gum).
E. tereticornis, Sm. (Forest Red Gum).
E. fasciculosa, F.v.M. (Pink Gum).

(*a*) PALE GUMS.

°Eucalyptus acervula, Hook.f.

"RED GUM OF TASMANIA." Plate 66.

TIMBER.

DESCRIPTION AND USES.

A hard, fairly close-grained timber, pale but inclined to be pinkish in colour, resembling *E. viminalis*, and in no sense Red as the term is applied to Gums on the mainland. It should be suitable for various purposes in the building trade, such as beams, girders, studs, rafters, wall-plates, flooring, coach and waggon work, being very strong for a "Gum." It is a first-class hardwood.

H. = Hard. W. = 64 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	10,550	11,340
Modulus of rupture in lb. per square inch ...	21,385	22,680
„ elasticity „ „ ...	3,066,200	3,000,000
Rate of load n lb. per minute	1 055	1,031

REMARKS.

This species was originally described by Hooker in his "Flora Tasmaniæ" (1859), but Mueller, in his "Eucalyptographia" (1879), places it under *E. Gunnii*, another species described by Hooker in the "London Journal of Botany" (III, 499, 1844). Bentham, in his "Flora Australiensis" (1866, Vol. III, p. 244), synonymises it under *E. Stuartiana*, a Victorian species. Maiden, in A.A.A.S., 1902, p. 377, classifies it as *E. Gunnii*, Hook., var. *acervula*, Deane and Maiden; whilst Rodway, in his "Flora of Tasmania" (1902), gives to it its due specific rank.

Morphologically the herbarium material has a resemblance to *E. paludosa*, R.T.B., a mainland species described in 1898 (Proc. Linn. Soc., N.S.W.), and especially are the fruits alike.

Maiden (Proc. Linn. Soc., N.S.W., 1901) in a paper on *E. Gunnii* Hook.f., places both the mainland *E. paludosa*, R.T.B., and the Tasmanian *E. acervula*, Hook,f., under *E. Gunnii*. But the results of an investigation show that these three are distinct both botanically and chemically.

E. paludosa, R.T.B., has a smooth bark, whilst *E. acervula*, Sieb., has mostly a rough bark, and could perhaps on occasions be classified with the hemiphloiæ group of Eucalypts.

The tree has usually a very bushy top, and the leaves are of rather a pendulous growth (L. G. Irby). *E. paludosa* is a fine typical tree, with stout outstretching branches and a straight stem. The "sucker" leaves are very different in appearance, shape, and colour from those of *E. Gunnii*, from which species it also differs in the number of flowers in the umbel, bark, and chemical constituents.

From an investigation it would appear that the chief botanical differences between *E. acervula*, Hook.f., and *E. paludosa*, R.T.B., are the timber and bark also the chemical constituents. *E. acervula* timber is harder, closer grained, and altogether superior to that of *E. paludosa*.

Systematic.

This appears to be a very constant species, all my specimens, which are numerous, from several localities, are very similar; it is most nearly allied to *E. viminalis* in the flowers, but differs in the sunk valves of the capsule, and leaves; the foliage is that of *E. Gunnii*, but the peduncles are always more than three-flowered, and the capsule is different. Trunk erect, often lofty; bark smooth or rough, pale or brown; branches more or less pendulous; leaves 2 to 4 inches long, ovate-lanceolate, or elliptical-lanceolate. Peduncles stout; flowers four to eight. The bruised foliage has a much sweeter odour than is usual in the genus.

Geographical Range.

Little Swanport, Tasmania.

Eucalyptus Banksii. J.H.M.

"GUM."

TIMBER.

DESCRIPTION AND USES.

Stated by Mr. J. H. Maiden to be a good hard timber, pale-coloured, but data not available in regard to its economic merits.

Systematic.

A very large tree, up to 100 feet, reminding one of *E. goniocalyx* in habit. Quite glabrous or the twigs a little glaucous. It has clean stems without ribbons, and no rough bark. It is locally known as "Woollybutt" because the bark is fuzzy to cut. Abnormal leaves nearly orbicular or oblong, cordate at the base, and stem-clasping, strictly opposite, gradually becoming broadly lanceolate and finally lanceolate; texture thickish, glabrous, slightly paler underneath, the main lateral veins conspicuous, and making approximately an angle of 45 degrees with the midrib. Normal leaves rather large, 9 inches long by 1½ broad not being an uncommon size. Equally green on both sides, venation rather prominent. Buds sessile, the head of four to seven either on a short strap-shaped peduncle or this may be absent. The buds more or less angular by mutual compression. Fruits small, under ¼ inch in diameter, conoid or nearly hemispherical, rim narrow and slightly domed, valves (only three in the specimen seen). Bark not as soft and as Box-like as in *E. Bridgesiana*.

Geographical Range.

Northern New South Wales, and Queensland Border.

Eucalyptus citriodora, Hook.f.

"LEMON-SCENTED GUM."

TIMBER.

DESCRIPTION AND USES.

This timber is not easily confounded with Spotted Gum with which botanists have been inclined to bracket it. The wood is not so open in the grain as Spotted Gum and so is harder than that species; pale grey or light chocolate in colour; resembling *E. eximia* in texture and gum veins, but somewhat darker in colour. Sapwood is attacked by borers. It is considered very durable and should be suitable for general commercial purposes.

H. = Hard. W. = 58 lb. per cubic foot.

Systematic.

A large tree with a smooth whitish bark. Leaves lanceolate, up to 6 inches long and 9 lines wide, acuminate, not shining; venation finely marked, lateral veins numerous, oblique, parallel or slightly spreading; intramarginal vein very slightly removed from the edge, which is more or less irregular. Flowers numerous in axillary panicles. Calyx hemispherical to slightly cylindrical, about 2 lines in diameter, pedicel under 2 lines. Operculum hemispherical, umbonate. Fruits ovoid, truncate, contracted at the edge, under 4 lines in diameter and 6 lines long, rim thin, valves opening downwards.

Geographical Range.

The North Coast district of Queensland.

*Eucalyptus corynocalyx, F.v.M.

"SUGAR GUM."

TIMBER.

DESCRIPTION AND USES.

J. E. Brown states in his Flora of South Australia that "the timber is remarkably heavy, much more so than *E. rostrata*; it is very dense, has great lateral strength, is very hard when dry, of a yellowish colour, and its durability and power of resistance against damp-rot and the attacks of white ants are of a high order. The timber is used for fencing purposes generally, railway sleepers, joists and rafters, piles, planking, naves, and felloes of wheels."

Systematic.

An average forest tree with a smooth bark in healthy trees, but becomes rough by decortication and dirty. Abnormal leaves rotund or sharply ovate, alternate, from 1½ to 2½ inches long, and from 1 inch to 1⅝ inch broad, generally alternate; lateral veins fairly prominent, with the intramarginal one well removed from the edge. Normal leaves somewhat diffuse: ovate-lanceolate, slightly falcate and oblique at base, veins prominent, numerous, and somewhat diffuse, intramarginal one ⅛ inch from edge. Umbels containing from 4 to 14 flowers. Pedicels rather slender, cylindrical, and from ⅜ inch long. Calyx-tubes club-shaped and over ¼ inch long. Ripe fruits, upon short pedicels, ovoid, ribbed, contracted at orifice, three-celled; valves deeply sunken.

Geographical Range.

It is restricted to the southern parts of South Australia and Kangaroo Island, where it forms the largest timber tree.

Eucalyptus Dunnii, J.H.M.

"WHITE GUM."

TIMBER.

DESCRIPTION AND USES.

White throughout, from the sap to the heart, sometimes coarse-grained and fissile. Apparently a tough wood. Stress is laid on the quality of this timber, as the name "White Gum" usually indicates timber of poor quality. It is considered locally as superior to *E. saligna* in durability, seasons better, and altogether it is a tougher timber than *E. saligna*, "Blue Gum," and becomes hard when exposed to the sun for a year or two. It is used for general building purposes, joists, rafters, &c. (J. H. Maiden.)

Systematic.

A large forest tree under 100 feet high. Bark rough at the base, but smooth onwards. Abnormal leaves nearly cordate to broadly lanceolate (often up to 4 inches long and 2 inches wide while still in the opposite stage), paler underside, the primary veins roughly parallel, intramarginal vein at some distance from the edge. Normal leaves lanceolate, 6 inches and more in length, with a usual breadth at the widest part of 1 to 1¼ inch; penniveined, intramarginal vein well removed from the edge. The normal leaves resemble those of the well-known *E. tereticornis* a good deal. Buds symmetrical in shape, the operculum conical, and the calyx of similar size and shape, tapering into the rather short pedicel. Flowers rather small; usually three to five in the umbel. Fruits hemispherical, barely ¼ inch in diameter, abruptly tapering into a pedicel of the same length. Peduncle of about ½ inch. Rim narrow and rather sharp, valves well exserted, and mostly four in the specimens seen.

Geographical Range.

Coastal districts northern New South Wales, extending into Queensland.

Eucalyptus Griffithsii, J.H.M.

"WHITE GUM."

TIMBER.

DESCRIPTION AND USES.

The type comes from Kalgoorlie, W.A., where, as a large tree it is now very scarce, because of the great demand for timber of every description for the mines and for ordinary domestic purposes all over the gold fields. (J. H. Maiden).

Systematic.

A large "White Gum" attaining a trunk diameter of 2 feet. Timber reddish-brown in colour and esteemed for fuel. Abnormal leaves thick, narrow-lanceolate, petiolate, but not seen in the strictly opposite stage; dull green, the same colour on both sides, intramarginal vein not obvious and not far removed from the thickened margin; venation, except the midrib, obscure. Normal leaves thick, narrow-lanceolate, 10 cm. long, 2 cm. broad, with a petiole of 2 cm. are common dimensions; glabrous or glaucous, equally green on both sides; intramarginal vein near the edge or forming the thickened margin, midrib distinct, lateral veins feather-like. Buds flat-topped, corrugated, with two of the ribs broadened almost into wings, so as to give the buds the appearance of having broad pedicels. The common peduncles rounded or only slightly flattened in threes. Fruits large, conoid, capsule white, valves distinctly exserted, rim flat, corrugated, two of the ridges usually dilated almost to wings.

Geographical Range.

Western Australia.

Eucalyptus globulus. Labill.

"BLUE GUM." Plate 67.

TIMBER.

Description and Uses.

This is one of the best known trees of the Genus and being a very rapid grower, has been extensively planted outside Australia, in Algeria, America, Europe, and South Africa—where timber is in great request for the mines. The wood is pale-coloured, fairly hard, easily worked, and useful more particularly for wharfing piles, heavy constructional works, and carriages, but not so much so for smaller work, as it warps badly in boards and is a very difficult timber to season. Some of the finest piers in England have been constructed with *E. globulus* timber imported from Tasmania.

H. = Hard. W. = 63 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in. (Grown in New South Wales).

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	8,840	8,190	9,000
Modulus of rupture in lb. per square inch ...	17,918	16 545	18,867
,, elasticity ,, ,, ...	2,880,000	2,400,000	2,560,000
Rate of load in lb. per minute	884	819	760

Anatomical Features.

This is a fairly uniform textured timber, and the fibres run in rather regular radial rows, whilst most of the organs are free of any deposit, and when such does occur it is in the parenchyma. The fibre walls are thick, leaving a small lumen with a line of simple perforations running in the long axis. The wood parenchyma favours a proximity to the vessels, which are generally free of tyloses. The rays are uniformly uniseriate, a few cells high.

Systematic.

A lofty tree with a smooth whitish bark. Abnormal leaves sessile or shortly petiolate, cordate, covered (as also the twigs) with a glaucous bloom. Normal leaves lanceolate, falcate, 9 inches to a foot long, rather thick, venation prominent, lateral veins spreading, oblique, intramarginal vein removed from the edge. Oil glands numerous. The large white or cream-coloured flowers, the warted, sessile fruits, the double operculum, the square branchlets, and the glaucous sessile "sucker" leaves are all characteristic features. Flowers large, generally occurring in threes in the axils of the leaves, sessile, or on very short thick pedicels. Calyx-tube broadly turbinate, thick, woody, more or less ribbed and rugose, or warty, or rarely smooth, ½ to ¾ inch diameter: Operculum flattened, surmounted by a thick centre, warty. A smooth secondary operculum is often found in this species. Stamens all fertile; anthers parallel. Ovary flat-topped. Fruit hemispherical, tuberculate, ribbed, with double rim, the upper one domed, valves exserted.

Geographical Range.

Tasmania, New South Wales, Victoria.

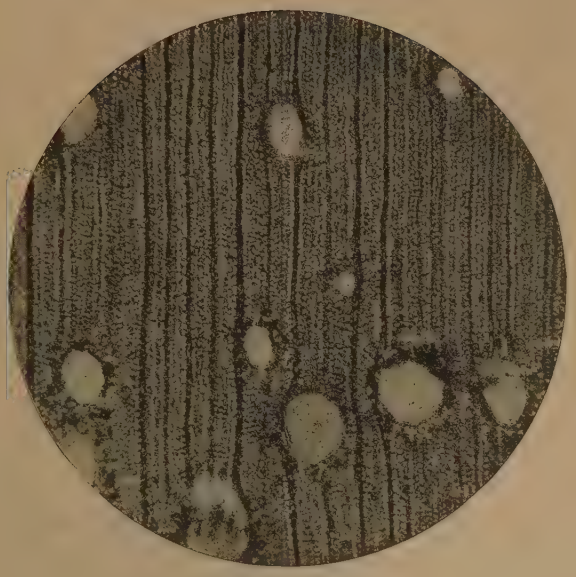
PLATE 67.

BLUE GUM (TAS.) OR EURABBIE.
(*Eucalyptus globulus*, LABILL.)

PLATE 68.

MOUNTAIN GUM.
(*Eucalyptus goniocalyx*, F.v.M.)

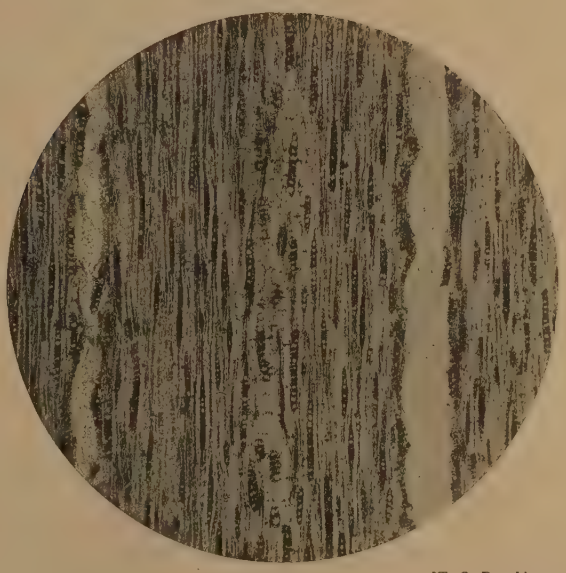
FIG. LI.



CROSS SECTION, showing regular arrangement of fibres and rays; wood parenchyma is clustered around the pores.

Micro. photo.]

RADIAL SECTION, showing full width of two rays, and compactness of fibres.



[*T. C. Roughley.*

TANGENTIAL SECTION, with portions of two vessels on left and right, with some wood parenchyma in the centre; rays throughout the fibres.

EUCALYPTUS GLOBULUS, LABILL.

Eucalyptus St. Johni. Sp. nov.

TIMBER.

DESCRIPTION AND USES.

This species was described as *E. globulus*, var. *St. Johni*, R.T.B., in the Victorian Naturalist, Vol. XXX, part 7, p. 127, but since then new data show it to be worthy of specific rank, and the opportunity is taken here of raising it to that systematic position, along with its congener *E. globulus* with which species it has in the past been confounded.

The timber is inferior to the wood of that species, and although classed as a hardwood, its technological value has not yet been investigated.

It appears to be a river-species and will probably be found to have a much wider distribution than its present known localities which are Lerderberg River, Bacchus Marsh, South and East Gippsland,—all in Victoria.

It was discovered in these districts by Mr. P. R. H. St. John, of the Melbourne Botanic Gardens, whose work amongst Victorian Eucalypts is well known.

Systematic.

A tree from 30 to 50 feet high, with a bark corresponding to most other Gums (smooth). The older seedling leaves oval, sessile, or shortly petiolate, and slightly or not at all cordate, about 1½ inch to 2 inches long, and ¾ inch to 1¼ inch or more wide; pale and glaucous on the under side. The abnormal leaves are longer, orbicular, cordate; lateral veins slightly oblique, parallel, and looping some distance from the edge; branchlets rectangular. Normal leaves lanceolate, falcate, as in the type, with similar venation, 2 inches to 2 feet or more in length, ½ inch to 3 inches broad, on petioles varying from 1 inch to 2 inches long; oil-dots conspicuous. The inflorescence is interesting, the early stages are characterised by a calyptra, covering two or three buds. The mature buds are more like those of *E. Maideni* than *E. globulus*, and differ from the latter in the absence of a second operculum. The calyx is compressed, sessile, about ½ inch long, ¼ inch or less in width, operculum acuminate, depressed, tuberculate, stamens inflexed before expansion; anthers parallel, opening by longitudinal slits. The fruits of this variety differ considerably in size and other features from the type; they measure about ½ inch long to ⅝ inch in diameter. The edges of the compressed calyx are here seen to have developed into slightly broken ridges; there is quite an absence of the tubercules so pronounced a feature on the type *E. globulus*; the rim is sharp and well defined, and slopes down or upwards to the summit of the valves, that vary in number from two to four.

It is the seedling leaves, the presence of a calyptra in the early buds, the absence of double opercula, and the fruits which justify, in my opinion, the tree being given specific rank.

Geographical Range.

Districts of the Lerderberg River, Bacchus Marsh, South and East Gippsland, Victoria.

Eucalyptus nitens, J.H.M.

TIMBER.

DESCRIPTION AND USES.

Almost flesh-coloured when fresh, drys very white; straight in the grain, not very easy to work to a smooth surface, being slightly teary and shrinking in the grain on exposure to the atmosphere (J. H. Maiden).

Systematic.

A very large tree, growing to a height of 200–300 feet, and with a diameter up to 17 feet. Known as "Giant Gum" or "White Gum" in the Bombala district of New South Wales, but, perhaps, more distinctively "Silver-top" or "Silver-top Gum," in reference to the smooth and shining bark on the upper part of the trunk. Bark deciduous, smooth, and even shining. Branchlets quadrangular and even winged. Abnormal leaves somewhat glaucous, cordate and stem-clasping, rather thin in texture, lateral veins spreading, the intramarginal vein scarcely obvious. Normal leaves somewhat shining; venation spreading, intramarginal vein distant from the edge; these leaves sometimes attain a length of over 1 foot, and a width of 3 inches, but usually they are very much smaller. Buds shining, angled; operculum pointed and shorter than the calyx-tube. Fruits shining, up to seven in the head as seen, sessile on a common peduncle of about ½ inch, 5 mm. long, ovoid, slightly angled, slightly contracted at the orifice, thin-rimmed, points of the valves sunk beneath the orifice or scarcely protruding.

Geographical Range.

The north-eastern part of Victoria, and the south-eastern portion of New South Wales.

*Eucalyptus goniocalyx, F.v.M.

"MOUNTAIN GUM." Plate 68.

TIMBER.

DESCRIPTION AND USES.

A splendid upstanding tree in gullies and ranges in the south-east of the Continent. The timber is very hard, heavy, straight grained, and one of the best pale-coloured hardwoods in Australia. A good timber for bridges, constructional work, heavy waggons, wharf and other branches of architecture requiring a strong timber.

H. = Hard. W. = 54 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	8,310	8,670
Modulus of rupture in lb. per square inch ...	17,312	18,241
,, elasticity ,, ,, ...	2,336,500	2,407,700
Rate of load in lb. per minute	1,187	1,083

Systematic.

A very tall tree with a smooth bark, except for a few feet at the base; found mostly on basalt or granite ridges. Abnormal leaves cordate, sessile, acuminate, 6 inches long, 2 inches broad, dark coloured above, lightish underneath. Normal leaves lanceolate, falcate, sometimes as much as 2 feet long and 3 inches broad; venation fairly distinct, intramarginal vein removed from the edge. Peduncles axillary, few under 1 inch long, flattened. Buds angular, sessile, or shortly petiolate, 7 to 8 lines long. Operculum shortly acuminate, obtuse. Fruit sessile, or petiolate, angular, oblong, rarely inclined to be hemispherical; rim narrow, valves slightly exserted.

The specific name of this species is one that might be applied to quite half-a-dozen eucalypts, and it is owing to this fact that several good species have, in the past, been confounded with it.

Geographical Range.

Coast Range from Blue Mountains, New South Wales, into Victoria, and South Australia.

*Eucalyptus maculata, Hook.f.

"SPOTTED GUM." Plate 69.

TIMBER.

Description and Uses.

A timber more generally used perhaps than any other Eucalyptus in New South Wales, as it possesses so many good qualities which form the desiderata of all the timber trades. As a wood-paving timber it has not a good reputation, but this is probably owing to a borer infected sapwood, which should be removed before the timber is used. The presence of this sapwood is one of the features by which to differentiate it from Tallow-wood. It is used extensively by wheelwrights, shipwrights, and house builders; also for parquetry, pick and axe handles.

This species is also a good cabinet timber; the waving of the grain is a distinct advantage in this connection, and materially assists in the decoration of furniture. The colour somewhat resembles that of English Oak, and it is about as hard and of the same texture to work as that wood. It is open in the grain and is not recommended to be polished, as, like Oak, it shows to better effect in the unpolished or waxed condition. A press of this timber was exhibited in the window of a Sydney firm lately, and looked really handsome. This piece of furniture is now at the Commonwealth Offices in Melbourne. For chairs, couches, &c., where strength is required, and the size of the timber to be used has to be limited, it ought to give every satisfaction.

H. = Hard. W. = 55½ lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	8,830	9,180	7,000
Modulus of rupture in lb. per square inch ...	17,660	18,360	14,000
,, elasticity ,, ,, ...	2,400,000	2,769,230	2,571,428
Rate of load in lb. per minute	1,103	1,020	1,000

Anatomical Features.

Fibres, vessels, and ray parenchyma form the chief wood elements in this timber; both wood parenchyma and tracheids are represented, but in a far less proportion. The fibres are small, with thick walls and small lumen, but arranged in regular radial rows; perforations exceedingly minute.

The vessels are fairly wide in diameter, and contain a fair amount of tyloses; the partition walls being rather numerous. The wood parenchyma is mostly clustered around the vessels, and seen best in a cross section. The tracheid cells are rather small, with walls covered with bordered pits. The rays are numerous, uniseriate, one cell in width, and contain, occasionally, in the cells, a yellowish secretion.

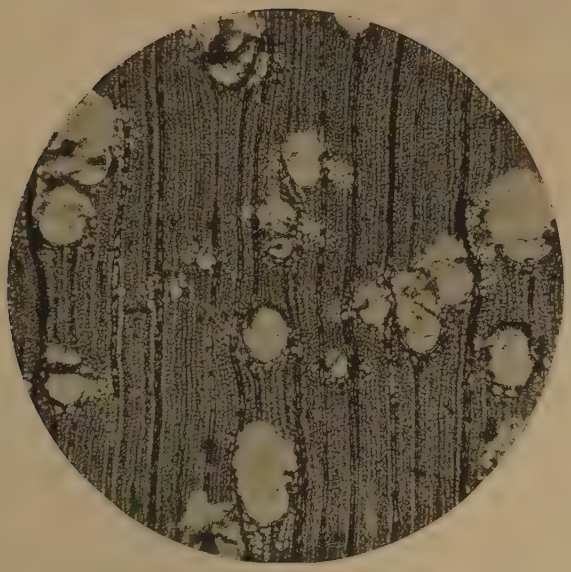
PLATE 69.

SPOTTED GUM.
(*Eucalyptus maculata*, HOOK.)

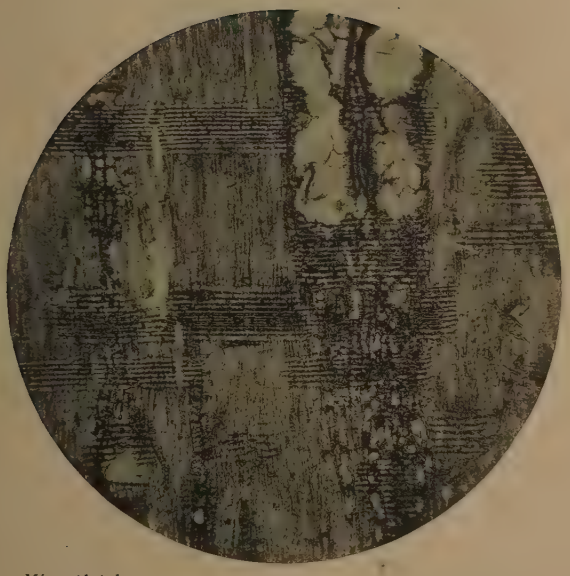
PLATE 70.

SOUTHERN BLUE GUM.
(*Eucalyptus Maideni*, F.v.M.)

FIG LII.



CROSS SECTION, showing small diameter of radially arranged fibres; large pores with adjacent parenchyma; and rays with brown content.



Micro. photo.]

RADIAL SECTION, showing uniform and heterogeneous rays; on the right at top a conjugate vessel is seen, followed by some wood parenchyma; fibres seen to be very compact.

[*T. C. Roughley.*

TANGENTIAL SECTION

EUCALYPTUS MACULATA, Hook.f.

Systematic.

One of the best known trees in the Coast district of these States. The common term "Spotted Gum" is a little confusing, as several species with a smooth bark are known by that name. The Queensland tree *E. citriodora* is sometimes placed as a variety of *E. maculata*, but the analogy is only in the shape of the seed-vessels. The two are quite distinct. It is an average forest tree amongst Eucalypts, with a smooth, dull, lead-coloured bark. The abnormal leaves large, sometimes a foot long, and 3 inches broad, lanceolate, venation oblique, well marked, intramarginal vein close to edge. The normal leaves ovate-lanceolate or lanceolate, 4 to 6 inches long, lateral veins oblique and distinct, the intramarginal one removed from the edge. The fruit ovoid-urceolate, usually ½ inch long and ¾ inch broad; rim narrow; capsule sunk.

Geographical Range.

Brisbane River, Queensland, to southern Coast districts of New South Wales.

Eucalyptus Maideni, F.v.M.

"WHITE GUM"—"BLUE GUM." Plate 70.

TIMBER.

DESCRIPTION AND USES.

This is rather a rare forest tree, but possesses a very strong timber, which is comparable to the very best Eucalyptus timber in Australia.

It is pale-coloured, hard, with an interlocked grain. Suitable for beams, bridge-decking, girders, heavy constructional works, carriage building and similar economics requiring strength.

H. = Hard. W. = 54 lb. per cubic foot.

Systematic.

Known as "Blue Gum" and "Spotted Gum" in different localities, and erroneously recorded as *E. globulus* from Araluen district. It is always a tall straight-growing tree, attaining a height up to 150 feet or even 200 feet, with a diameter up to 4 feet, with a smooth bark, chalky-white or bluish, hence its local name "Blue Gum." The abnormal leaves are very large, glaucous, round or heart-shaped, sessile and stem-clasping in the sharply angular and winged branches, gradually becoming alternate, petiolate, lanceolate to elongate, and often very narrow lanceolate, more or less curved. The normal leaves often attain a length of 12 inches or more, much resembling those of *E. goniocalyx*, F.v.M.; venation distinct, intramarginal vein removed from the edge. Peduncle axillary, short, much flattened. Flowers few, sessile. Calyx angular or flattened, operculum much constricted, sessile, or shortly pedicellate, turbinate to slightly hemispherical. Fruit ½ inch in diameter, sessile, or shortly pedicellate, turbinate to slightly hemispherical, rim thick, valves slightly exserted.

Geographical Range.

The Ranges of New South Wales, near the Victorian border.

Eucalyptus Mundijongensis, J.H.M.

"TUART."

TIMBER.

DESCRIPTION AND USES.

Pale coloured, economics unknown.

Systematic.

A tall tree about 80–100 feet high, and 5 feet diameter about 4 feet from the ground. Bark hard, flaky, breaking off in long woody strips, the smaller branches smooth; it has a good deal in common with the Peppermint barks of the Eastern States (*R. piperita*, S.M.). Abnormal leaves coarse, thick, coriaceous; venation not very prominent, somewhat spreading at the base in some specimens, in others at an angle of about 60 to the midrib and roughly parallel. Intramarginal vein not conspicuous and somewhat removed from the edge. Normal leaves narrow-lanceolate, shiny, coriaceous, venation inconspicuous and penniveined, margins thickened, and the fine intramarginal vein not close to the edge. Buds pointed, clavate, slightly angular, the operculum pointed, very slightly exceeding the calyx-tube in diameter, and about half as long as the same. Fruits with short peduncles to nearly sessile, cylindroid, with a thin grooved rim, tips of valves well sunk below the orifice.

Geographical Range.

Western Australia.

Eucalyptus ochrophloia, F.v.M.

"YAPUNGAH."

TIMBER.

DESCRIPTION AND USES.

A very hard, heavy, close-grained, light brownish timber, but unfortunately has not a wide geographical range.

It is a valuable forest tree for the warm interior of the Eastern States, as it would supply a timber of equal qualities to the best of the Eucalypts of these districts.

Systematic.

A large "Mallee" or small tree, bark smooth; leaves lanceolate, acuminate, under 9 inches long, about 6 lines broad, shining, coriaceous; petiole about 1 inch long; venation raised, lateral veins oblique, spreading, intramarginal vein removed from the edge. Oil glands numerous. Flowers in terminal or axillary panicles. Buds attenuate, about 1 inch long, six or more on a peduncle 6 lines long, with angles so pronounced as to be almost winged. Calyx about 4 lines long and 1 line in diameter, winged, tapering into a comparatively long pedicel. Operculum shorter than the calyx, acuminate, angled or winged. Ovary flat-topped. Fruit elongated, 2 lines in diameter, 7 lines long, tapering into the pedicel, slightly contracted at the edge; rim thick, capsule deeply sunk.

Geographical Range.

Central New South Wales, and Queensland.

Eucalyptus regnans, F.v.M.

"GIANT GUM." Plate 71.

TIMBER.

DESCRIPTION AND USES.

This is a tree very highly appreciated in Victoria for its timber, which ranks along with *E. delegatensis*, *E. obliqua*, *E. Australiana*, and *E. rubida* as the freest and easiest working of the Eucalypts, consequently as Eucalyptus timbers, they are, compared with the rest of the hardwoods, light in weight and rank practically as softwoods, but, of course, not in the sense of imported Conifer softwoods or our Red Cedar, Rosewood, &c. The annual rings are as equally marked as American and European Pines. It is very pale, almost white straight in the grain, free-working seasons quickly and well. It resembles in texture and physical properties the Ashes and Hickories of the Northern Hemisphere. It is used extensively for general house building, coach and carriage work, and recently has come very much in vogue in the furniture and cabinet trades.

H. = Moderate. W. = 41 lb. per cubic foot.

FIG. LIII.

CROSS SECTION, showing large thin-walled pores; and regular radial rows of fibres.

Micro. photo.]

RADIAL SECTION, showing parts of two vessels; compact masses of fibres, and rays.

[*T. C. Roughley.*

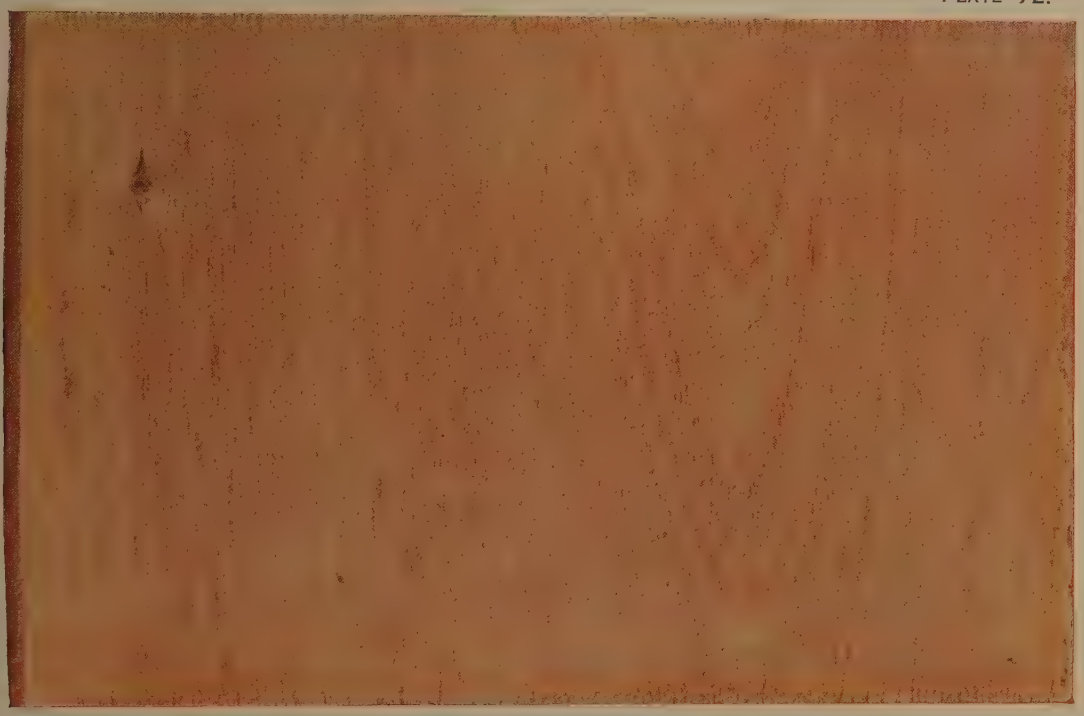
TANGENTIAL SECTION, showing fibres, width of ray cells; and portions of two vessels.

EUCALYPTUS REGNANS, F.v.M.

PLATE 71.

GIANT GUM.
(*Eucalyptus regnans*, F.v.M.)

PLATE 72.



RED GUM (TASMANIA).
(*Eucalyptus urnigera*, HOOK.)

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	5,100	4,480	3,730
Modulus of rupture in lb. per square inch ...	12,662	10,730	.....
,, elasticity ,, ,, ...	3,110,400	3,275,673	3,240,625
Rate of load in lb. per minute	784	.....	.....

ANATOMICAL FEATURES.

A very close, compact wood, the fibres being rather more concentrated at the winter growth, and pores are very numerous, scattered throughout the other wood elements, but more numerous in the spring period; the thickness of the walls of the fibres vary according to the season's growth in which they occur, being thicker in the winter portion; the lumen consequently varies in diameter, being wider in the summer section. The vessels are almost free from tyloses, and the wood parenchyma arranged around this element is limited in amount. The rays are numerous, uniseriate, and a few cells high, and only occasionally do they contain a palish substance.

Systematic.

"A tree at last stupendously tall." Bark outside whitish and smooth, except at the stem base; leaves of rather thin texture from elongate to broad lanceolate, much unilaterally curved, shining on both sides, the secondary venules slightly spreading; oil-dots extremely numerous and pellucid; umbels mostly solitary. Flowers small; lid hemispherical; anthers minute, renate. Fruit quite small, generally semi-ovate; its border depressed or nearly flat; valves enclosed; leaves of young seedlings opposite, sessile, cordate-roundish, whitish from waxy bloom.

Geographical Range.

Eastern Victoria and Tasmania.

*Eucalyptus urnigera, Hook.f.

"RED GUM." Plate 72.

TIMBER.

DESCRIPTION AND USES.

As obtains in all the Tasmanian Eucalypts, it is pale-coloured, fairly open and straight, often with a wavy grain. It has also a good sheen, which together with the wavy figure, should be very effective when turned or polished. As a hardwood it is easy to work and should be suitable for cabinet work, house building, flooring, waggon work, ship building, and turned table legs, columns, newel posts, &c.

H. = Hard. W. = 61 lb. per cubic foot.

Systematic.

A tree usually small, with spreading branches and drooping branchlets, often glaucous attaining sometimes 50 feet, with a pale brown smooth bark. Leaves ovate, oval-oblong or lanceolate, obtuse, 2 to 4 inches long, straight or rarely oblique, very thick so as to conceal the oblique, rather regular veins. Flowers three together or rarely solitary, pedicellate, on rather long usually recurved terete pedicels. Calyx-tube more or less urceolate, contracted under the somewhat dilated orifice, rather above 3 lines long, and as much in diameter. Operculum short, obtuse or shortly conical. Fruit hard, oblong-ovoid or nearly globose, but always more or less urceolate, the rim narrow, slightly prominent, the capsule sunk.

Geographical Range.

The Mountain districts of Tasmania.

*Eucalyptus viminalis, Labill.

"MANNA GUM"—"RIBBONY GUM." Plate 73.

TIMBER.

DESCRIPTION AND USES.

A very widely distributed tree in the eastern States, and almost invariably known by the common name of Manna Gum, from the sugary substance exuded by the leaves.

The wood is generally ranked as second-class, owing to a tendency to warp and twist, in some cases, when used before properly seasoned. In parts of the State where other timber is scarce, it is employed largely in house building, being tough and strong, and is also regarded as a good carriage timber; makes into fine pick and hoe handles, bars, &c. It is pink coloured, straight, and open grained, dresses and planes easily.

H. = Moderate. W. = 55 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	7,630	7,760	8,400
Modulus of rupture in lb. per square inch ...	15,260	15,520	16,800
,, elasticity ,, ,, ...	2,028,169	2,322,580	2,215,384
Rate of load in lb. per minute	545	646	600

Systematic.

This is perhaps the most widely distributed species of the genus in these States, as well as probably one of the tallest. Sometimes a very large tree. Bark smooth, decorticating in long strips, or rough and dark coloured. Abnormal leaves sessile, rounded at the base, acuminate; normal leaves lanceolate, mostly under 6 inches long; venation prominent, lateral veins oblique, spreading. Peduncles axillary, about 2 or 3 lines long, three-flowered. Calyx hemispherical, under 2 lines in diameter, pedicel very short. Operculum hemispherical, acuminate. Fruit hemispherical, shining, reddish coloured, 3 lines in diameter, rim rounded, valves much expanded and well exserted.

Geographical Range.

The Tablelands of New South Wales, Victoria, South Australia; Tasmania.

PLATE 73.

MANNA GUM.
(*Eucalyptus viminalis*, LABILL.)

PLATE 74.

A BLUE GUM.
(*Eucalyptus Deanei*, J.H.M.)

Eucalyptus vitrea. R.T.B.

"WHITE TOP MESSMATE."

TIMBER.

DESCRIPTION AND USES.

A very pale brownish-coloured timber with fairly close grain, similar, both in colour and texture to the Stringybarks. It is subject to gum-veins, they being almost as numerous, occasionally, as in *E. corymbosa*, Bloodwood. The timber should be suitable for certain parts of heavy waggons, and fencing.

H. = Hard. W. = 61½ lb. per cubic foot.

Systematic.

A fair average-sized forest tree, with smooth limbs and a Peppermint bark at the butt, or smooth to the ground. Abnormal leaves alternate or opposite, with a short petiole, or sessile, ovate-lanceolate, acuminate, under 6 inches long, 1½ inch broad; lateral veins diverging from below the middle of the midrib, prominent on both sides, intramarginal vein removed from the edge. Normal leaves narrow, lanceolate, about 6 inches long, and 6 to 9 lines wide, shining on both sides, a dull green when fresh, but drying a light slate colour, petiole short; lateral veins few and almost parallel to the midrib. Peduncles axillary, short, 2 to 3 lines long, bearing generally five to eight flowers; buds from 2½ to 4 lines long. Operculum hemispherical, shortly acuminate. Fruit hemispherical, shining, about 3 lines in diameter, rim thick, red, slightly convex, pedicel about 1 line long.

Although only very recently described, it is found to have a fairly extensive range, throughout which it preserves a constancy of specific characters. The term "White-Top" is, no doubt, used to distinguish it from the Peppermint, *E. Australiana*, not that the leaves are white, but only because they have a whitish appearance glinting in the sunlight.

Geographical Range.

As far as known the Crookwell and Moss Vale districts, and the mountains north of Marulan.

(*b*) RED GUMS.

Eucalyptus Deanei. J.H.M.

"BROAD-LEAVED BLUE GUM." Plate 74.

TIMBER.

DESCRIPTION AND USES.

A very fine forest tree, with a smooth bark, and one worthy of forest culture, as the red coloured timber is in a class between that of *E. tereticornis* and *E. saligna*, and from both of which it differs very little in general anatomical characters, weight and colour.

It so far has not come upon the timber market, but is nevertheless mentioned here on account of its prospective forest importance.

H. = Moderate. W. = 56 lb. per cubic foot.

Systematic.

It is a very large tree, with smooth and sometimes almost glaucous bark, a little ribbony at the butt. Some of the trees resemble Blue Gum, *E. saligna*, a good deal. In others it forms a gnarled tree up to 7 or 8 feet in diameter as seen, the scrambling branches in some cases actually touching the ground. The gnarled trees have spreading buttresses, and a thin scaly or ribbony bark extending a good distance up the trunk; in others the roughish bark extends but a short distance. The young foliage is especially broad, shining, particularly on the upper surface, and bears some superficial resemblance to pear-foliage. The buds are clavate. Fruits small, under 5 cm., cylindrical or rarely conoid, slightly urceolate, rim flat, tips of the valves exsert.

Geographical Range.

Northern districts of New South Wales, extending to the southern parts of Queensland.

Eucalyptus dealbata, A.Cunn.

"INLAND RED GUM."

TIMBER.

DESCRIPTION AND USES.

A tree with an extensive geographical distribution yielding a timber of a rather second-class character and so its forestry value is not so high as its congeners, although it is suitable for minor jobs. It is red in colour, but not so close grained as *E. tereticornis*, being more porous and lighter in weight. It dresses and works well, and could be employed for indoor work, and in colour and texture approximates to *E. saligna*, but full data concerning its economics are still in the desiderata stage.

H. = Hard. W. = 56 lb. per cubic foot.

Systematic.

A fair-sized tree, from 60 to 80 feet high, with a smooth bark, which is sometimes rough at the base. Abnormal leaves lanceolate, acuminate, or shortly acuminate, 4 to 6 inches long, and under 2 inches broad, pale bluish; intramarginal vein well removed from the edge, especially in the short broader leaves. Leaves lanceolate, generally under 6 inches long, venation well marked, lateral veins oblique, spreading, intramarginal vein removed from the edge. Peduncles axillary, short, 4 lines long, with 4 to 6 flowers in the umbel. Calyx conical, about 2 lines long; pedicel short, 1 to 2 lines long, occasionally angular. Operculum conical, obtuse, equal to or longer than the calyx. Fruit hemispherical, about 3 lines in diameter, rim thick and flat, or slightly convex, valves acuminate, exserted, often resembling those of *E. oleosa*, F.v.M.

Geographical Range.

Central-western districts of New South Wales to northern district (Tenterfield), Queensland.

Eucalyptus Parramattensis, C. Hall.

"WHITE GUM."

TIMBER.

DESCRIPTION AND USES.

A recent addition to our knowledge of Eucalyptology, being described by Dr. Cuthbert Hall in 1912.

The timber is placed amongst the lightest in weight of our hardwoods, is pale reddish in colour, easy to work, but is not of great strength, and more resembles in characters that of *E. viminalis*.

H. = Hard. W. = 56 lb. per cubic foot.

Systematic.

A medium-sized tree, 15–30 feet high, as far as seen; with smooth whitish bark, drooping, giving the tree a light graceful appearance; stem 2–2½ feet in diameter. Found growing in a flat, low-lying situation, on poor clay soil in company with *E. haemastoma*. Abnormal leaves large, up to 7 or 9 inches long, over 1 inch broad, petiolate, lanceolate, falcate. Normal leaves lanceolate, sometimes falcate, but smaller than the primary leaves, subcoriaceous, sometimes shining; venation moderately well marked, the reticulations giving a roughish surface; lateral veins oblique, fairly distant, and having a looping arrangement with the marginal vein, which is clearly defined and fairly removed from the edge. Flowers in axillary peduncles 4 to 6 lines long, bearing few flowers, four to seven. Buds on a short pedicel, 1½ to 2 lines long. Calyx-tube 1½ inch long; operculum hemispherical, and domed or conical and shortly acuminate, much longer than the calyx-tube. Fruit hemispherical, 3 lines in diameter, rim rounded to the dome of the ovary or base of valves, which are free from the rim and often recurved.

Geographical Range.

The district of Parramatta, and Milton, New South Wales.

Eucalyptus Dawsoni, R.T.B.

"SLATY GUM." Plate 75.

TIMBER.

DESCRIPTION AND USES.

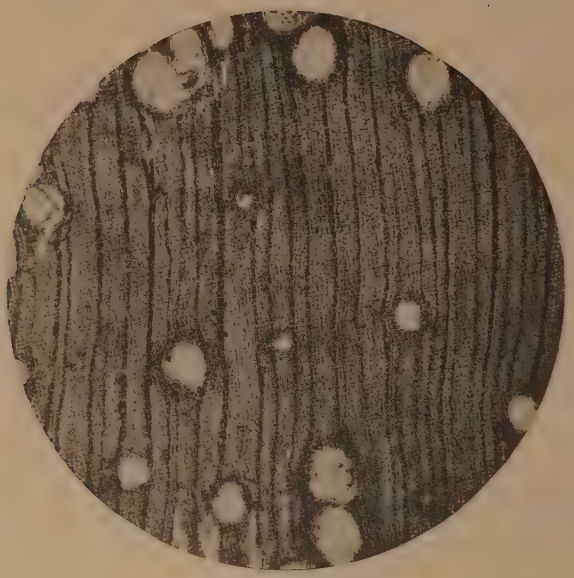
This is a forest tree worthy to rank along with the best Ironbarks for durability, texture, and hardness, and is about equal in weight to that class of timber.

It is, when first cut, bright red, but afterwards deepens to a darker colour; very close grained, dresses to a surface resembling horn, and is particularly suitable for heavy constructional work, building structures of all kinds, and sleepers, as it does not crack in the sun.

Slaty Gum has a comparatively restricted distribution, but, nevertheless, amongst red timbers it is one of the finest, for it is hard, heavy, close grained, and polishes well. It could be turned to splendid use where strength, weight, and durability are required, such as bridges, wharves, storey-posts, beams, sleepers, railway carriage parts, &c. At present it is quite unknown on the Sydney market.

H. = Very hard. W. = 66 lb. per cubic foot.

FIG. LIV.



CROSS SECTION, showing that the diameter of the fibres is very small; numerous rays are seen in black lines due to the dark deposit in them.

Micro. photo.]

RADIAL SECTION; the principal feature being the dark deposit in the rays.

[*T. C. Roughley.*

TANGENTIAL SECTION; the vessels all plugged with tyloses.

EUCALYPTUS DAWSONI, R.T.B.

PLATE 75.

SLATY GUM.

(*Eucalyptus Dawsoni*, R.T.B.)

PLATE 76.

YATE GUM.

(*Eucalyptus cornuta*, LABILL.)

ANATOMICAL FEATURES.

The fibres are arranged in more regular rows than obtains in most Eucalypts, and vary in diameter, the lumen being about half the diameter and contains a red secretion. The pores are fairly numerous, but the wood parenchyma is quite limited, and these, like the fibres, also contain a red substance. The fibres are remarkable for the number of comparatively large pits which are more numerous than obtain in any other species examined, and not only bordered, but are often in double rows, as in the case of Conifers, Araucarias, and Agathis. They are quite a specific character. Their position is unique in that they occur in the tangential walls. The rays are very numerous, uniseriate, nearly always only one cell wide, and, like the wood parenchyma, contain a solid red secretion. The vessels are well plugged with tyloses.

Systematic.

One of the finest upstanding trees of the Australian forest, having a clean, white or slaty-coloured bark. It is characterised by its long clean barrel, absence of lateral branches, and glaucous foliage and branchlets. The leaves are glaucous in both forms, but the abnormal leaves of the younger trees are oval, 2 to 5 inches long, or oval lanceolate 5 inches long, and petiolate; venation well marked, oblique. The normal leaves are lanceolate or narrow lanceolate, but rather small for so tall a tree generally measuring up to 5 inches long; the venation is not too distinct, lateral veins oblique, no intramarginal vein. Flowers mostly in terminal panicles, or axillary racemes at the end of the branchlets. Fruits very small.

Geographical Range.

The north-west districts and ranges near the Liverpool Plains.

Eucalyptus Behriana, F.v.M.

"RED GUM."

TIMBER.

DESCRIPTION AND USES.

A reddish-brown coloured timber with a very small, wavy, close, interlocked grain. Suitable for small work requiring great strength.

Systematic.

A moderately-sized tree of the "Mallee" country. Branchlets terete. Bark smooth, greenish, hard. Leaves ovate, ovate-lanceolate, lanceolate, oval, acuminate or shortly acuminate, smooth, coriaceous, occasionally shining, 2 to 3 inches long; venation fairly prominent, lateral veins very oblique, distant, spreading; intramarginal vein removed from the edge. Flowers in rather lengthened, terminal panicles, sessile; calyx angular, almost cylindrical, under 2 lines long. Inner operculum hemispherical, shortly acuminate, outer one very small, membranous and persistent. Fruit small, shining, under 2 lines in diameter, top-shaped, slightly hemispherical, truncate, rim comparatively thick, capsule sunk, valves enclosed.

Geographical Range.

West Wyalong district of New South Wales; South Australia; Victoria.

*Eucalyptus cornuta, Labill.

"YATE GUM." Plate 76.

TIMBER.

DESCRIPTION AND USES.

A hard, close-grained, interlocked, heavy, durable timber, in grain and colour something like a Red Ironbark, as *E. siderophloia* for instance; suitable for any purpose where strength and durability are required and weight is no objection. J. E. Brown states :—" In this tree we possess a most excellent timber, and one highly suited and used for shafts, spokes, naves, felloes, boat-ribs, and agricultural implements generally. It is well worthy of cultivation."

H. = Very hard. W. = 63 lb. per cubic foot.

Systematic.

A fair-sized tree, about 80 feet high and up to 3 feet in diameter, with a smooth bark. The bark brown or black, hard, rugged, persistent, half-fibrous or fibrous, or the bark smooth and falling off in pieces. Leaves lanceolate or ovate-lanceolate, mostly under 4 inches long, rather thick, the veins irregularly oblique, often more conspicuous than in the adjoining species; the intramarginal one at a distance from the edge. Peduncles axillary, terete or slightly compressed, each bearing six to twelve or even more flowers, sessile, but not immersed in the receptacle. Calyx oblong-turbinate, about 3 lines long and rather less in diameter. Operculum 1 to 1½ inch long, more or less tapering upwards, but obtuse. Fruit obovoid-truncate or shortly cylindrical, about 4 lines long, not contracted at the orifice, the rim narrow and scarcely distinct from the slightly convex summit of the fruit; valves when open raised and acuminate by the long, often convenient points formed by the split and persistent base of the style.

Geographical Range.

South-west corner of Australia.

Eucalyptus Thozetiana, F.v.M.

TIMBER.

DESCRIPTION AND USES.

The timber of this tree is probably harder than that of any Eucalyptus tree. It is very heavy, close grained and interlocked, has a chocolate colour, and much resembles in texture, colour, and hardness, Lignum-vitæ, *Guaiacum officinale*, Linn., of Central America. In fact, it is more deserving the title of Australian " Lignum-vitæ " than other trees of the Continent passing under that name, and it is so named in the museum specimens. It is no doubt very durable and suitable for sleepers, posts, rails, bridges, cogs, machine bearings, mallets, &c.

H. = Extremely hard. W. = 77 lb. per cubic foot.

Systematic.

An erect, graceful tree, rarely attaining a height of over 70 feet, with a smooth, compact, whitish bark, decorticating in hard short flakes at the base. Branchlets angular, but soon terete, reddish-coloured. Leaves mostly alternate, from linear lanceolate in the adventitious shoots, and from lanceolate to oblong-lanceolate in the normal form, under 6 inches long, and ½ inch wide occasionally. Venation rather obscured in the thick epidermis: lateral veins sparse, oblique, distant: intramarginal vein removed from the edge. Flowers small on axillary peduncles or terminal panicles. Fruits small, oval urn-shaped, angled, under 3 lines long, and under 1½ line in diameter. Valves depressed.

Geographical Range.

Southern interior of Queensland, and northern interior of New South Wales.

Eucalyptus leucoxylon, F.v.M.

"BLUE GUM." Plate 77.

TIMBER.

DESCRIPTION AND USES.

The wood of this tree is of a very superior class, and ranks amongst the best which the State of South Australia produces. It is very durable, possesses great lateral strength, and when dry is hard and tough; in colour it is pinkish. Amongst the more important purposes for which it is applied, we may enumerate those of railway sleepers, bridge piles and planking, naves and felloes of wheels, waggon shafts, telegraph poles, axe handles, &c.

Systematic.

An average forest tree with a smooth bark, ovate, occasionally more ovate-lanceolate and cordate, sucker leaves thin in texture, light green in colour. Leaves conspicuously pendulous, chiefly falcate, decidedly coriaceous, irregular and scattered, dull olive green on both surfaces; veins numerous, netted and indistinct, the intramarginal one well removed from the edge; petioles slender, semi-compressed, about $\frac{3}{4}$ inch long. Flowers slender, and extra axillary containing from two to eight flowers; pedicels $\frac{1}{2}$ inch long, angular or coractate; calyx pyriform or semi-ovate, about $\frac{1}{4}$ inch long, and occasionally angular. Operculum regularly conical, invariably leaning to one side, about $\frac{1}{4}$ inch long and sometimes almost angular. Fruits semi-ovate, truncate, over $\frac{1}{4}$ inch long; rim thick and convex; valves short and sunken. Seeds three to eight in number.

Geographical Range.

Kangaroo Island and Mainland of South Australia.

Eucalyptus longicornis, F.v.M.

"MORRELL."

TIMBER.

DESCRIPTION AND USES.

J. E. Brown, in his Forest Flora of Western Australia, states concerning this timber that it is hard, heavy and strong in every way, especially in its lateral tension, and is of a dark reddish colour. For such works as general wheel manufacture, shafts, blocks, tool handles, mallets and other trades requiring timber of a strong durable character the Morrell timber is highly recommended.

H.= Extremely hard. W. = 74 lb. per cubic foot.

Systematic.

This tree appears never to have been systematically described fully. Mueller, in any of the references given of it in botanical works, regarded it as a variety of *E. gracilis* and left it at that. It is a large tree with a bark something like "Yate," *E. cornuta*.

Geographical Range.

South-east corner of Western Australia.

Eucalyptus intertexta, R.T.B.

"COOLABAH."

TIMBER.

DESCRIPTION AND USES.

Amongst Eucalyptus Species occurring in the interior of New South Wales, Queensland, and South Australia, this species has no rival for durability and hardness of timber, and is of some forestry, as well as commercial, importance as it is one of the few large trees growing in the "Mallee" country.

The timber is red in colour, of an exceptional interlocked character (hence its specific name), a feature that stamps it at once as a timber mostly suitable for sleepers, bridge work, and all similar applications requiring strength, durability and hardness. It is one of the best of our hardwoods for such purposes.

H. = Extremely hard. W. = 73 lb. per cubic foot.

Systematic.

A large tree, up to 80 feet high, and 3 feet or more in diameter. Bark smooth, nearly to the ground; butt-bark hard and persistent, extending a few feet up the trunk; the smooth bark has patches or spots, and varies much in colour, from brownish, or all shades of a lighter grey, to sometimes chalky white. Abnormal leaves similar in shape to mature ones, but at times somewhat broader. Leaves lanceolate-acuminate, mostly under 6 inches long, of a pale yellowish or sometimes bluish colour on both surfaces, not shining; lateral veins spreading, but not prominent, and almost quite hidden, intramarginal vein close to the edge. Fruit variable in shape, sometimes cylindrical, with the thin rim incurved, whilst at other times pilular in form, with a constriction below the rim, 2 to 3 lines in diameter.

Geographical Range.

The Central-western districts of New South Wales.

Eucalyptus loxophleba, Benth.

"YORK GUM." Plate 78.

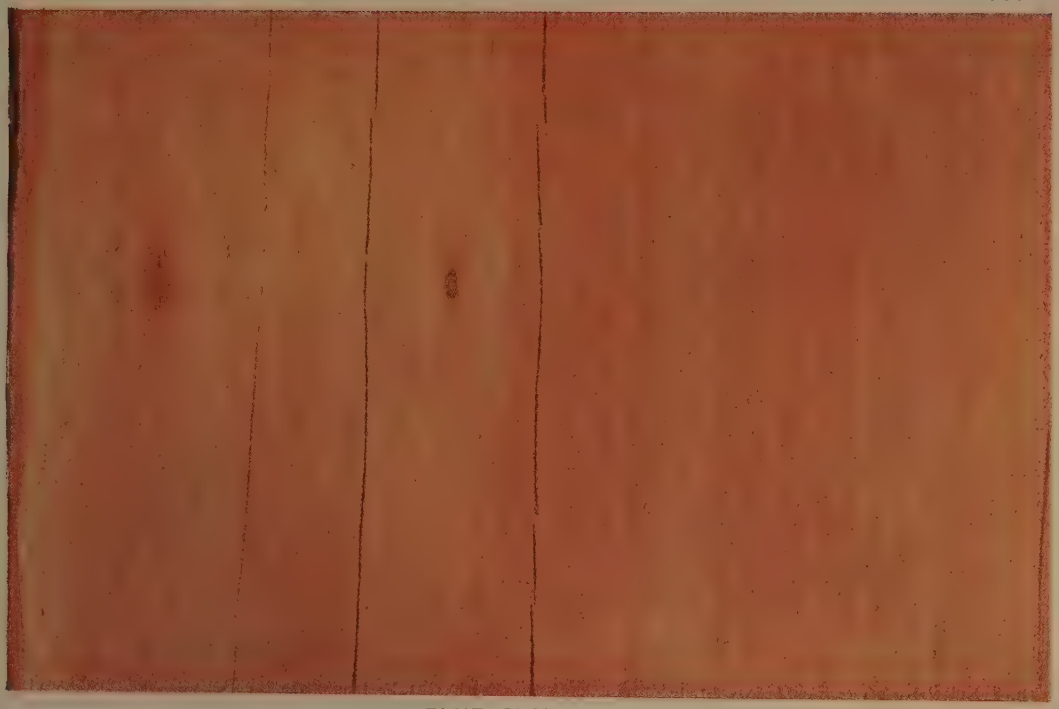
TIMBER.

DESCRIPTION AND USES.

A fair average forest tree rarely exceeding 100 feet in height. The wood is exceedingly hard, heavy, and tough, and is considered one of the best for constructional works where great strength and toughness are required. Suitable for general shipwright's work, heavy carriages, also naves, felloes, &c.

H. = Very hard. W. = 63 lb. per cubic foot.

PLATE 77.



BLUE GUM, S.A.

(*Eucalyptus leucoxylon*, F.v.M.)

PLATE 78.

YORK GUM.

(*Eucalyptus loxophleba*, BENTH.)

Systematic.

A tree from 10 to 30 feet high, with a rough ash-grey fibrous bark (Oldfield); 40 to 45 feet, the bark separable in layers (Preiss). Leaves lanceolate, acuminate, narrow, and often 4 to 5 inches long, or the lower ones shorter and broader, all rather rigid, with very oblique, rather distant and prominent veins, the intramarginal one distant from the edge. Peduncles axillary or lateral, terete or slightly flattened, each with a dense umbel of six to twelve flowers. Calyx-tube obconcal, 2 to 2½ or rarely nearly 3 lines long, tapering into a short pedicel. Operculum hemispherical or obtusely conical, shorter than the calyx-tube. Fruit narrow-obovoid, truncate, straight or slightly contracted at the orifice, rarely above 3 lines long and 2 lines diameter, the rim narrow, the capsule deeply sunk.

Geographical Range.

Western Australia, Collie and York districts.

Eucalyptus occidentalis, Endl.

"THE FLAT-TOPPED YATE."

TIMBER.

DESCRIPTION AND USES.

The timber is hard and strong and is sought for by wheelwrights, and is probably as valuable as that of *E. cornuta*, the ordinary "Yate."

Systematic.

A tall tree, leaves scattered, oval or oftener sickle-shaped lanceolar, of thick consistency and of equal colour on both sides; their lateral veins neither prominent nor crowded, moderately spreading, the circumferential vein somewhat distant from the edge; flowers in umbel on stalks compressed, sometimes dilated, axillary or lateral, solitary, rarely a few terminally jointed, bearing from three to twelve flowers. Operculum cylindrical, conical, about twice as long as the obconic bell-shaped tube of the calyx. Fruits obovate bell-shaped or truncate pear-shaped, four rarely three or five celled, not conspicuously angular, but sometimes streaked; rim rather narrow, finally prominent; valves about half exserted.

Geographical Range.

Western Australia, Tone River to regions inland near Cape Le Grand, and Broken Ranges near Orleans.

*Eucalyptus propinqua, H.D. et J.H.M.

"GREY GUM." Plate 79.

TIMBER.

DESCRIPTION AND USES.

One of the finest forest trees on the North Coast of New South Wales, and of great forestry and commercial importance, and one that should find extensive culture in future forestry activity. Its timber characters place it in the same class for high quality as *E. tereticornis*, *E. rostrata*, *E. Dawsoni*, and *E. punctata*. It is reddish-coloured, hard, close grained, and splendid working, seasons well, and is altogether a first-class wood for heavy constructional work, coach building, house building, and even heavy joinery work.

H. = Hard. W. = 70 lb. per cubic foot.

Systematic.

A large straight growing, cylindrically stemmed tree, found up to 4 or 5 feet in diameter, and 120 feet and more in height. The bark is grey, and peels off in large, longitudinal, irregular patches, leaving a smooth white surface. The bark closely resembles, and is, perhaps, not to be distinguished from that of *E. punctata*. Seedling leaves more broadly lanceolate, and with the marginal vein more distinct from the edge than in the case of the mature leaves, at first opposite. Mature leaves narrow-lanceolate, and very uniform, average length 4 to 5 inches, breadth $\frac{3}{4}$ inch. Veins not prominent; lateral veins nearly parallel; marginal vein on or very close to the edge of the leaf as a very general rule. Calyx-tube hemispherical, and longer than the operculum. Operculum hemispherical, but but with a low pointed apex. Fruits very uniform in size, about $2\frac{1}{2}$ lines broad by $1\frac{1}{2}$ line deep; the rim channelled. The valves are well exserted. The fruits as regards the rim and general contour, considerably resemble those of the smaller forms of *E. resinifera* more so than those of *E. punctata*.

Geographical Range.

New South Wales and Queensland.

*Eucalyptus punctata, DC.

"GREY GUM." Plate 80.

TIMBER.

DESCRIPTION AND USES.

This timber has a feature which detracts from its forestry value, viz., a tendency to pipe, but nevertheless it ranks as first-class, with a deep red colour and hardness that place it in the same class as Ironbarks for durability, strength, and texture, in fact, it is often very difficult to differentiate planks of this timber from that of Ironbark. For sleepers especially, it is excellent, and probably quite equal to Ironbark. It can also be used for heavy constructional work, house building, posts, &c.

H. = Hard. W. = 64 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The ollowing were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	9,600	10,200
Modulus of rupture in lb. per square inch ...	22,163	23,548
,, elasticity ,, ,, ...	3,290,453	3,522,346
Rate of load in lb. per minute	850	800

Systematic.

A large tree, with a dirty-looking, smoothish, or friable bark, and rectangular branchlets. Abnormal leaves ovate, lanceolate, often shortly acuminate, 4 to 6 inches long, pale coloured on the underside, sometimes almost oblique, membranous, margins recurved, venation distinct, oblique, spreading. Mature leaves lanceolate, sometimes oblique, pale on the underside, varying in length and breadth up to 6 inches and 2 inches respectively, thinly coriaceous; venation not pronounced, lateral veins fine, oblique, parallel, intramarginal vein close to the edge. Peduncles axillary, flattened, under 6 lines long, about six flowers in the umbel. Calyx in the bud stage angular, conical, in the flower stage hemispherical. Operculum conical or hemispherical, and much acuminate, under 3 lines long. Ovary slightly domed. Fruit hemispherical, 4 lines in diameter, rim thick, domed, valves obtuse, exserted; pedicel thick, short.

Geographical Range.

The Coast districts of New South Wales and Queensland.

PLATE 79.

SMALL-FRUITED GREY GUM.
(*Eucalyptus propinqua* D. AND M.)

PLATE 80.

GREY GUM.
(*Eucalyptus punctata*, DC.)

*Eucalyptus redunca, Schau.

"WANDOO." Plate 81.

TIMBER.

DESCRIPTION AND USES.

One of Western Australia's best forest trees, yielding one of the finest hardwoods of that extensive area. The timber is reddish-brown, very hard, heavy, strong, and almost indestructible. It can be used for any purpose where strength and durability are required, such as bridges, wharves, beams and girders, storey posts, joists, mining timbers, framing for railway rolling stock.

The species furnishes a hard, particularly tough, heavy, and durable timber, prized for building purposes, various implements, and especially for wheelwrights' work, supplying thus the best of shafts, cogs, naves, spokes, and felloes in Western Australia. Large dimensions of timber are available from this tree, as stems do occasionally occur to a diametric breadth of 17 feet towards the base. (J. E. Brown).

H. = Hard. W. = 73 lb. per cubic foot.

Systematic.

In rich and deep soil attaining a height of 120 feet, but in poor ground, sometimes over not inconsiderable stretches of country, remaining of shrubby growth, though flowering copiously; estimated by the Lands Department of Western Australia to occupy naturally about 10,000 square miles, being thus next to *E. marginata*, the most widely distributed Eucalyptus in the south-western portion of our Continent, even the leading other timber species there occupy very much less extent of country.

Geographical Range.

South-western portion of Australia.

*Eucalyptus rubida. H.D. et J.H.M.

"CANDLE BARK."

TIMBER.

DESCRIPTION AND USES.

Timber of a pale pinkish colour, hard, tough, rather open in the grain, said by some to warp badly in seasoning; if this is correct it is not a good marketable timber, but as it is used extensively for constructional purposes in the districts where it grows, that contention can scarcely be borne out.

Systematic.

A fairly large tree with a smooth bark. Abnormal leaves from nearly orbicular to nearly oblong, often emarginate or retuse, eventually taking on a lanceolate shape; strictly opposite; sometimes stem clasping and even more or less connate. Very glaucous as a general rule. Normal leaves dull green, of similar tint on both sides, narrow lanceolate, the intramarginal vein scarcely removed from the edge; the lateral veins roughly transverse, often glaucous, sometimes very much so. Buds axillary, in threes, sessile or with very short stalklets. Operculum nearly hemispherical when ripe, hardly pointed; rather shorter than the calyx; conoid when less ripe. Fruit top-shaped, spreading at the orifice; usually about 3 lines in diameter, sometimes nearly hemispherical, shiny or glaucous; the rim roundish and convex. Valves exserted.

Geographical Range.

The mountain ranges in the south and south-eastern portions of New South Wales. Also found in Victoria and South Australia.

Eucalyptus Seeana, J.H.M.

TIMBER.

DESCRIPTION AND USES.

A hard, fairly close-grained, red timber, similar in colour and texture to *E. rostrata* or between this species and *E. tereticornis*. It is considered to be very durable in the ground, suitable for fencing-posts, bridge work, &c., and should be suitable for wharf construction, coach and railway waggon work, or for various avenues of the building trade.

A tree worthy of reafforestation.

H. = Hard. W. = 56 lb. per cubic foot.

Systematic.

Mr. Maiden states that *presumably* this is *E. tereticornis*, Sm., var. *linearis*, Baker and Smith, Research on "The Eucalypts," p. 174.

It is a smooth-barked tree, of medium size, with blotches on the bark resembling that of *E. tereticornis*. Abnormal leaves petiolate, narrow-linear and falcate, 4 inches long and ⅜ inch wide, with numerous prominent transverse veins. Normal leaves with long slender petioles, the leaves attaining a length of 9 inches and more, with an average width of say ⅜ inch; texture rather thin, equally dull on both sides, with numerous minute transverse veins; the intramarginal veins distinct and somewhat removed from the edge of the leaf. The foliage slender, graceful and drooping. Buds narrow, the operculum long and tapering, of the tereticornis type. The inflorescence in the axils of the leaves. The peduncle and pedicel of the fruit are but slightly angular. Fruit small, nearly hemispherical, its diameter about 3/16 inch, the rim well defined, forming a broadish band, with the top of the rim truncate and the valves (three or four in the specimens seen) well exserted.

Geographical Range.

North Coast district of New South Wales.

*Eucalpytus salmonophloia, F.v.M.

"SALMON GUM." Plate 82.

TIMBER.

DESCRIPTION AND USES.

This is one of the hardest and heaviest of our Eucalyptus timbers, having an interlocked grain and a deep red colour, much resembling *E. siderophloia*, the "Broad-leaved Ironbark" of the Eastern States. A very suitable timber for heavy constructional works of all kinds, piles, bridge-decking, beams, storey posts, heavy carriage and waggon works.

H. = Extremely hard. W. = 74 lb. per cubic foot.

PLATE 81.

WANDOO.

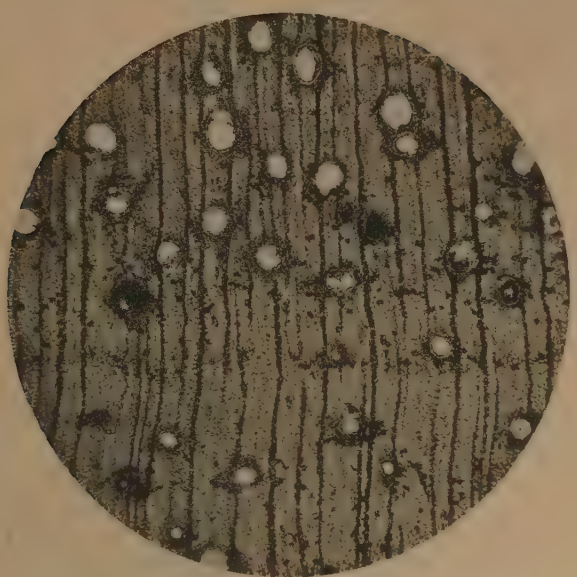
(*Eucalyptus redunca*, SCH.)

PLATE 82.

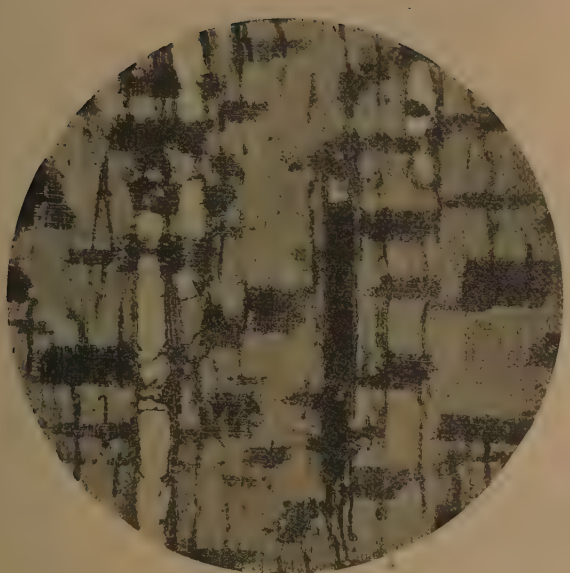
SALMON GUM.

(*Eucalyptus salmonophloia*, F.v.M.)

FIG. LV.



CROSS SECTION, showing comparative small diameter of pores for a Eucalyptus, and small closely-packed fibres between the rays; wood parenchyma (black spots) scattered amongst the fibres as well as around the pores.



Micro. photo.]

RADIAL SECTION, showing rays and a vessel filled with a deposit (red); fibres closely massed.

[*T. C. Roughley*

TANGENTIAL SECTION, showing in left portion wood parenchyma filled with a deposit.

EUCALYPTUS SALMONOPHLOIA, F.v.M.

ANATOMICAL FEATURES.

The specific characteristic of this species is the numerous bordered perforations of the fibres, and the large amount of brown deposit found in all the elements. The wood parenchyma is scattered, rather than in proximity to the vessels. The rays are very numerous, a few cells high and nearly all uniseriate.

Systematic.

A splendid tall tree 100 feet high, with a smooth, whitish bark; branchlets thin, slightly angular; leaves sparse, of rather thin consistence, narrow-lanceolate, shining, and of equal colour on both sides; their lateral veins spreading at an acute angle, very much concealed, the marginal vein but slightly removed from the edge; umbels solitary, axillary or soon lateral, containing ten or fewer rather small flowers; stalklets about as long or somewhat shorter than the semiovate tube of the calyx; lid conical-semiovate, slightly longer than the tube; fruits small, nearly semi-ovate three or rarely four-celled; valves exserted, almost awl-shaped, pointed.

Geographical Range.

Swan River and extending to Victoria Spring to arid interior region, Western Australia.

Eucalyptus Torelliana, F.v.M.

TIMBER.

DESCRIPTION AND USES.

This has rather an unusual colour for Eucalyptus wood, being brown or light chocolate coloured, and open, straight grained. In texture not unlike *E. maculata*, Spotted Gum, and would pass as a good substitute for that timber. Like most Eucalypts, on end section the medullary rays are not visible, and judging by the annual rings, it appears to be a fairly fast-growing tree. It could be used for general building purposes, coach and wheelwrights' work, heavy rolling stock, shipbuilding, bridge and wharf structures, &c. Its durability in the ground is as yet unknown.

H. = Hard. W. = 59 lb. per cubic foot.

Systematic.

A tall tree with smooth bark. Branchlets moderately stout and, as well as the petioles, hispidulous, scabrous. Leaves from chartaceous to coriaceous, 2 to 3 inches long, 1½ to 2 inches broad, broad or cordate ovate, the under side pale, the intramarginal vein distant from the edge; petioles about ½ inch long. Panicles terminal, flowers numerous, glabrous, branches spreading, pedicels very short. Calyx-tube campanulately semi-ovate. Operculum shining, smooth, scarcely exceeding 2 lines broad. Stamens inflexed in the bud, anthers oblong. Stigma not dilated. Ovary three-celled.

Geographical Range.

Northern districts of Queensland.

*Eucalyptus rostrata, Schl.

"MURRAY RED GUM." Plates 83 and 84.

TIMBER.

Description and Uses.

This is one of the best-known trees in Australia, and one much appreciated by the Forester. It is invariably found on River banks or old watercourses, and is thus a water-loving species, and the Murray River Red Gum forest reserves are famous as showing how this tree responds to forest culture.

It has been extensively cultivated abroad, where it preserves its home specific characters.

It is a red-coloured, free-working, close, interlocked, hard timber, and is in great demand for bridge and similar heavy structures, wood blocks for street-paving, sleepers, coach and carriage work. It could also be used for heavy cabinet work. It seasons well and is very durable.

H. = Hard. W. = 51½ lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	5,000	4,800
Modulus of rupture in lb. per square inch ...	10,000	9,536
,, elasticity ,, ,, ...	.....	.....
Rate of load in lb. per minute	555	685

Anatomical Features.

The anatomical structure of this wood agrees in almost every particular with that of *E. marginata* and *E. resinifera*, so that a description of them applies equally as well to this hardwood.

Systematic.

A tall tree, whitish, smooth, persistent bark. Leaves lanceolate, falcate, up to 9 inches long and 1 inch wide, of medium thickness, of equal colour on both sides; venation distinct, lateral veins oblique, spreading, numerous, intramarginal vein removed from the edge. Peduncles axillary, terete or flattened, about 6 lines long, with an umbel of less than a dozen flowers; pedicel almost filiform, and about 4 to 6 lines long, or short and thick. Calyx uniformly hemispherical, from 1½ to 3 lines in diameter. Operculum variable in shape, sometimes larger than the calyx, and then it is conical and obtuse, but the most common form is hemispherical, surmounted with a very prominent beak. Fruit hemispherical, 2 to 4 lines in diameter, and consistently so, rim slightly variable in convexity, valves exserted, prominent.

Geographical Range.

River banks of all the eastern States of Australia, except Tasmania.

FIG. LVI.

CROSS SECTION, showing numerous pores nearly all tylosed; the small dark spots mark the wood parenchyma and the black lines the rays. The fibres are exceedingly small in diameter and very compact.

Micro. photo.]

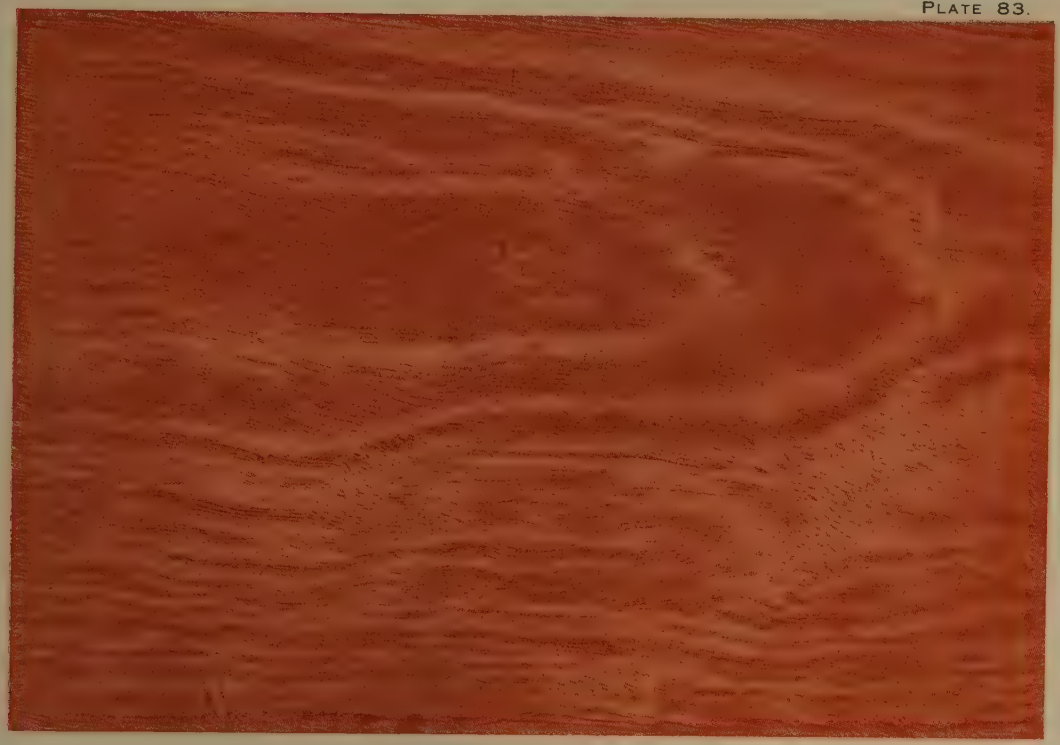
RADIAL SECTION, showing portions of five vessels, the three on the right plugged with tyloses, those on the left containing a red substance in addition; only a few rays are seen.

[*T. C. Roughley.*

TANGENTIAL SECTIONS, the central mass composed of fibres and small rays; vessels on the outer edges.

EUCALYPTUS ROSTRATA, SCHL.

PLATE 83.



MURRAY RED GUM.
(*Eucalyptus rostrata*, SCHLECT).

PLATE 84.

MURRAY RED GUM.
(FIGURED.)
(*Eucalyptus rostrata*, SCHLECT.)

Eucalyptus salubris, F.v.M.

TIMBER.

DESCRIPTION AND USES.

Mr. Worsby of the Public Works Department, Western Australia, says of this timber that he finds it highly suited for cabinet work, as shown by some fine specimens of furniture which he himself has designed and executed.

Systematic.

At full age the tree attains not rarely a height of 120 feet, or occasionally even of 150 feet; the stem is tall in comparison to the few and scattered main branches of the tree. Bark smooth, greyish, shining to some extent, brownish and greenish tinged. Branchlets sometimes with a white bloom. Leaves of thin consistence, scattered, linear-lanceolate, shining and dark green on both sides; their veins subtle, ascending in a very acute angle, the intramarginal vein but little removed from the edge of the leaf. Umbel few flowered, solitary axillary or later lateral, umbel stalks linear, wedge-shaped, much compressed. Calyx twice as long as the stalks, lid semi-elliptical, blunt, of about double the length of the semi-ovate calyx-tube. Fruits small, semi-ovate, three or rarely four-celled; the margin narrow, valves short, nearly deltoid, emersed.

Geographical Range.

Dry country east of the Darling Range, Western Australia.

*Eucalyptus saligna, Sm.

"SYDNEY BLUE GUM." Plates 85 and 86, and Bark Plate 86A.

TIMBER.

DESCRIPTION AND USES.

The timber is one of our finest, hard red-woods, being of medium weight, easy to work, durable, dresses well, and is in general demand throughout the timber trades, being superior to the Tasmanian Blue Gum which it in no way resembles. It is a favourite wood with coachbuilders generally.

It is used for felloes more particularly, general coach and wheelwrights' work, carriage framing, building construction, wood blocks, sleepers, shipbuilding, &c.

It is straight grained, open, takes a good polish, and looks well in cabinet work.

H. = Hard. W. = 46 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

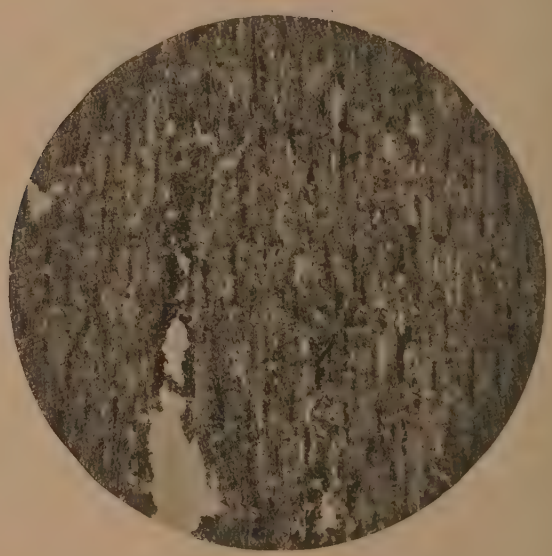
	No. 1.	No. 2.	No. 3.
Breaking load in lb.	5,330	6,000	5,500
Modulus of rupture in lb. per square inch ...	11,605	13,235	12,168
„ elasticity „ „ ...	2,200,754	2,916,000	3,085,114
Rate of load in lb. per minute	761	750	916

FIG. LVII.

CROSS SECTION, showing small diameter of the fibres; upper pores filled with tyloses, rays in dark lines.

Micro. photo.

RADIAL SECTION, showing compact fibres, and rays with a dark deposit; black line in left half is a wood parenchyma filled with similar substance.



T C Roughley

TANGENTIAL SECTION.—The rays showing in short black lines. The open part at the bottom is a broken vessel.

EUCALYPTUS SALIGNA, SM.

PLATE 85.

SYDNEY BLUE GUM.
(*Eucalyptus saligna.* SM.)

PLATE 86.

SYDNEY BLUE GUM.
(FIGURED.)
(*Eucalyptus saligna.* SM.)

PLATE 86A.

SYDNEY BLUE GUM.

(*Eucalyptus saligna*, SM.)

Systematic.

A tall tree, growing to its greatest height and perfection in the gullies of the coast and mountains. Bark, either smooth bluish-white with a silvery sheen, or rough at the base, similar to that of *E. robusta*. Abnormal leaves alternate, lanceolate. Leaves lanceolate, occasionally falcate, drying a bluish-green, pale on the underside, intramarginal vein close to the edge; transverse veins numerous, fine and parallel, slightly oblique. Fruit hemispherical, about 3 lines in diameter, rim thin, valves very slender and well exserted.

It is usual botanically to include under the species (*E. saligna*), two trees known commercially as "Blue" and "Flooded Gum" respectively, but in this work the two are separated, the latter being placed as a variety of the former under the varietal name of *pallidivalis*. The timbers of the two are quite distinct, and are so sold to the trade. The fruits of the variety are very constant throughout the area of distribution—the exserted white valves and glaucous calyx being very characteristic.

Geographical Range.

At the head of gullies in the Coastal districts of New South Wales and Queensland.

*Eucalyptus saligna, Sm. Var. pallidivalvis, R.T.B. et H.G.S.

"FLOODED GUM."

TIMBER.

DESCRIPTION AND USES.

This is a fine forest tree, growing on moist land and consequently the timber is of a more porous nature than its allied species. The timbers certainly have a resemblance, but they can be easily separated when the characters of each are known. Thus this species always has a frayed surface after sawing as against a smooth one in the case of *E. saligna*. Again, this timber is lighter in colour, and more open in the grain. The colour is pale red, with a sheen on a freshly-planed surface. It is of medium weight for a hardwood, fairly straight grained, fissile and free-working.

It could be used for rustic weather-boards, house building generally (interior), some kinds of carriage and cabinet work, and shipbuilding.

H. = Hard. W. = 50 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	7,890	9,810	9,510
Modulus of rupture in lb. per square inch ...	15,832	20,086	19,212
,, elasticity ,, ,, ...	2,590,600	2,748,800	2,432,400
Rate of load in lb. per minute	986	1,090	1,188

Systematic.

The herbarium material of this tree is altogether much coarser than that of the type. The leaves are large and broad generally, dry a fresh green colour, with a whiteness near the midrib, and a pale undersurface. Branchlets angled, peduncles flattened, about 6 lines long, bearing generally over six flowers, pedicel 4 lines long. Calyx 2 lines in diameter, tapering into the pedicel. Fruit uniformly pear-shaped, on a short, thick pedicel, or sessile-glaucous, about 3 lines in diameter, sometimes angled, rim thin, capsule sunk; valves exserted, obtuse, white.

Geographical Range.

North Coast district of New South Wales, extending from Port Jackson to Lismore.

*Eucalyptus tereticornis, Sm.

"FOREST RED GUM." Plate 87.

TIMBER.

DESCRIPTION AND USES.

One of the finest forest trees, and is of special forestry importance as, unlike most of the genera, it flourishes on a variety of soils and is suitable for afforestation in most of the forest areas of the States.

It yields a splendid, red-coloured hardwood, with straight or slightly interlocked grain. It dresses well, takes a good polish, and makes handsome red furniture.

It is, however, used in a general way for constructional works, such as bridges, piles, wharfs, carriage-building, shipbuilding, wood-blocking, and many other avenues of the timber trade.

H. = Hard. W. = 63 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	9,190	7,000	7,990
Modulus of rupture in lb. per square inch ...	19,010	14,000	16,195
,, elasticity ,, ,, ...	2,151,390	1,565,200	1,871,100
Rate of load in lb. per minute	1,021	1,166	998

Systematic.

A tall tree with a smooth bark. In addition to the common name given above it is sometimes called "Blue Gum," or merely "Red Gum." Abnormal leaves orbicular to broadly lanceolate, 4 inches in diameter and under 6 inches long; sometimes oblique, venation very pronounced on the under side oblique, spreading, intramarginal vein removed from the edge. Fruit hemispherical, 2 to 4 lines in diameter, rim domed, valves exserted, acute. Inflorescence either in axillary peduncles or in terminal panicles. Peduncles flattened, varying in length up to 9 lines, with seven to nine flowers in the umbel.

Geographical Range.

The Coastal districts of New South Wales, Queensland, and Victoria.

Eucalyptus squamosa, H.D. et J.H.M.

"IRONWOOD" OR "SCALY-BARKED RED GUM."

TIMBER.

DESCRIPTION AND USES.

A rather rare tree of medium height, found growing in poor iron or sand-stone ridges and therefore of forestry value fron this standpoint. The timber is particularly hard and heavy, close and interlocked in the grain, a deep red colour, and cut into sleepers or girders would be most

PLATE 87.

FOREST RED GUM.
(*Eucalyptus tereticornis*, SM.)

PLATE 88.

PINK GUM, S.A.
(*Eucalyptus fasciculosa*, F.v.M.)

difficult to separate from Ironbark, for which it is an excellent substitute. It is a very desirable hardwood for heavy constructional works of all kinds, and would also probably make good wharf piles. It should be excellent for wood blocks or sleepers.

H. = Very hard. W. = 68 lb. per cubic foot.

TRANSVERSE TEST OF TIMBER.

(The following was made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

Breaking load in lb.	3,180
Modulus of rupture in lb. per square inch ...	6,360
„ elasticity „ „ ...	911,820
Rate of load in lb. per minute	530

Systematic.

A medium sized tree, with a scaly bark somewhat resembling that of *E. corymbosa*, but the scales thinner. Occasionally the bark is smoothish, as at Cabramatta and Richmond, N.S.W. Abnormal leaves ovate, and finally ovate-lanceolate. Leaves narrow to rather broad lanceolate, or ovate-lanceolate, slightly falcate, 3½ to nearly 6 inches long, pale green to glaucous, the surface glandular-punctate, intramarginal vein very near the edge, transverse vein numerous and fine. Fruit nearly hemispherical, with a slight tendency to constriction at the orifice. Size about 4 lines broad by 3 lines deep. Rim sunk. Valves three or four and slightly exserted.

Geographical Range.

County of Cumberland, Rylstone and Mudgee districts, New South Wales.

Eucalyptus maculosa, R.T.B.

"MOUNTAIN SPOTTED GUM."

TIMBER.

DESCRIPTION AND USES.

A hard, close-grained timber of a pinkish colour, similar to that of *E. viminalis;* sometimes has a very pretty, wavy, fiddle-back figure. It is used to a great extent in the districts where it grows for fencing and general purposes.

H. = Hard. W. = 62 lb. per cubic foot.

Systematic.

A tree with a smooth bark to the ground. Abnormal leaves lanceolate, 2 or 3 inches long, opposite, very narrow. Normal leaves narrow, lanceolate, falcate, not shining, same colour both sides, venation obscure, intramarginal vein close to the edge, lateral veins oblique. Some trees have the leaves quite rigid and erect. Flowers on axillary slender peduncles, under 6 lines long, bearing from four to sixteen, occasionally twenty, sessile or shortly pedicelliate flowers. Calyx turbinate, about 1 line long; operculum of equal length, obtuse. Fruit in the early stage much resembles that of *E. haemastoma*, var. *micrantha*, and probably this species has been placed in the past under that variety. In the mature stage the fruit is turbinate, and resembles some forms of *E. Smithii*, R.T.B., about 2 lines in diameter, rim domed, valves exserted, obtuse.

Geographical Range.

Coastal Ranges and districts of New South Wales and Victoria.

Eucalyptus ovalifolia, R.T.B.

"RED GUM."

TIMBER.

DESCRIPTION AND USES.

A tree with a restricted geographical distribution, being only so far recorded from the western slopes of the Main Dividing Range, near Rylstone. The timber is dark-reddish coloured, hard and straight in the grain, occasionally interlocked. It apparently is an excellent timber, and very durable in the ground. It is a tree deserving of attention in any afforestation scheme.

When growing on poor ironstone ridges the tree becomes rather stunted, and the stem has a tendency to barrel, so that it then yields only small specimens of timber. It is suitable for all kinds of heavy work.

H. = Hard. W. = 65½ lb. per cubic foot.

Systematic.

A medium sized tree, with a smooth bark, decorticating at the base of trunk, producing a roughish appearance. Leaves small, of light yellowish colour, sometimes glaucous oval, or ovate, shortly acuminate, mostly 2 inches long and ¾ inch wide, rarely 3 inches long; venation faintly marked, lateral veins distinct, oblique, spreading, the intramarginal vein removed from the edge, producing at the base of the leaf a trinervate appearance. Flowers in axillary or terminal panicles. Calyx under 2 lines long, 1 line in diameter, tapering into a slender pedicel. Operculum hemispherical, depressed, very shortly acuminate. Fruit small, 2 lines long and 1¼ line in diameter, rim thin, contracted slightly at the orifice, valves not exserted.

Geographical Range.

The Central Ranges in the Coast district of New South Wales, near Bathurst and Rylstone.

Eucalyptus ovalifolia, R.T.B. Var. lanceolata, R.T.B. et H.G.S.

A "RED GUM."

TIMBER.

DESCRIPTION AND USES.

A fine forest tree, which although limited in geographical distribution, yet produces an excellent timber, having a "box" texture, is red in colour, straight grained, even in texture, planes and works well, and certainly is one of the best of our Eucalyptus red-woods. It has not yet come into commerce, but is eminently suited for architectural works of all kinds, and for decoration such as rails, bannisters, open roofs, cabinet work. It, of course, could be used for all the other purposes to which best Eucalyptus timbers are employed, and is highly appreciated by timber users in the district in which it occurs.

H. = Hard. W. = 65 lb. per cubic foot.

Systematic.

A typical forest tree with a smooth bark. Leaves lanceolate, 4 to 6 inches long or more, rarely above 1 inch broad, thin, almost membranous, not shining, dull green colour both sides, occasionally drying brownish; petiole slender, over 1 inch in length; venation finely defined, lateral veins oblique, spreading, the distant ones being more distinct, intramarginal vein removed from the edge. Inflorescence in axillary or terminal panicles; pedicel about 3 lines long, slender. Calyx conical, 2 lines in diameter. Ovary flat-topped. Operculum hemispherical, shortly acuminate. Fruit conical, about 2 lines or slightly more in diameter, rim thin, contracted, sometimes lacerated.

Geographical Range.

The central districts of New South Wales.

Eucalyptus fasciculosa. F.v.M.

"PINK GUM." Plate 88.

TIMBER.

DESCRIPTION AND USES.

The timber is hard, dark reddish in colour and fairly heavy. Used extensively by coach builders and wheelwrights. (J. E. Brown.)

H. = Hard. W. = 67 lb. per cubic foot.

Systematic.

A tree of moderate size, having a diameter at base of about 12 inches, occasionally 15 inches or more. Abnormal leaves opposite, alternate and oblong in shape. Normal leaves smooth, and more thick than thin in consistency, dull beneath, and somewhat shining on top surface; lanceolate to ovate, more or less falcate, 3 to 6 or more inches in length and ½ inch to over 1 inch in breadth; primary veins fairly numerous, fine, somewhat hidden, spreading, opposite and almost parallel,circumferential vein close to the edge of the leaf. Flowers in umbels almost invariably in terminal clusters forming a spreading panicle. Calyx-tube obconical or turbinate in shape, ⅛ inch broad, somewhat angular, and gradually tapering into a short pedicel. Operculum almost regularly broadly conical, nearly as long as the calyx tube. Fruits pyriform truncate, ⅛ inch broad, a little more in length, slightly contracted at orifice; faintly angular; generally four-celled. Valves sunken or nearly deltoid; the testa of fertile seeds netted.

Geographical Range.

The Lofty Ranges of South Australia, St. Vincent's Gulf, and Kangaroo Island.

Eucalyptus Le Souefii. J.H.M.

TIMBER.

DESCRIPTION AND USES.

In colour cigar-brown. (J. H. Maiden.)

Systematic.

A tree of medium size; bark flaky at the butt, the greater portion of the trunk and branches smooth. Abnormal leaves ovate-lanceolate to ovate, glaucous, coarse, in some specimens petiolate, thick, venation distinct, rather more prominent on the underside, venation spreading, becoming more pinnate as growth proceeds, the intramarginal vein distinctly removed from the edge. Normal leaves lanceolate, petiolate, commonly 10 cm. long and 2 broad, with petioles of 2 cm., coriaceous, equally green on both sides, the intramarginal vein distinct from the edge, midrib prominent, feather-veined. Fruit nearly hemispherical, about 1 cm. in diameter, with numerous longitudinal ribs or nearly smooth, rim broadish, valves exsert.

Geographical Range.

Western Australia in Kalgoorlie district, also near Coolgardie.

Eucalyptus Benthami, J.H.M. et R.H.C.

"FLOODED GUM."

TIMBER.

DESCRIPTION AND USES.

Pale pink when fresh, and of medium hardness and fissility. (J.H.M. et R.H.C.)

Systematic.

A large conspicuous White or Flooded Gum, rather erect in habit, with more or less rough-flaky bark at the butt; such bark may be almost absent, or sometaimes extending to the first fork. The rough bark, rather hard, but rarely almost fibrous, and terminating in short ribbons. Commonly 3 to 4 feet, but sometimes 6 feet in diameter, and 60 to 100 feet high. Abnormal leaves very thin, very glaucous when young, paler on the underside, veins distinct, lanceolate to ovate-lanceolate, and cordate, amplexical, bluntly pointed or acute. Leaves slightly glaucous, lanceolate, petiolate, somewhat falcate; the lateral veins, which are irregularly pinnate, prominent, the intramarginal vein distinctly removed from the edge. Buds usually glaucous, up to 7 in the head, slightly unceolate, operculum pointed, about half the length of the calyx-tube. Fruits in the half-grown state glaucous, somewhat unceolate, to nearly hemispherical, with a well-defined rim.

Geographical Range.

Nepean River, New South Wales, and the Camden district.

PEPPERMINTS.

This is a well distributed group in the coastal districts of New South Wales, throughout Victoria, and Tasmania, and practically forms an opposite curve of distribution to the Bloodwoods. Colour does not help much to distinguish timbers in this group, for they may be nearly all placed in one class, *i.e.*, pale coloured, the specific differences being often almost too delicate to define. They are generally recognised by the bark, which is known to bushmen as peppermint bark, but to be more correct, the name is derived from the presence in the leaves of a peppermint ketone, Piperitone, which constituent gives the peppermint odour of the oil.

Species Illustrated in Colour :—

E. Australiana, R.T.B. et H.G.S. (Narrow-leaved Peppermint).

E. piperita, Sm. (Sydney Peppermint).

*Eucalyptus amygdalina, Labill.

"BLACK PEPPERMINT."

TIMBER.

Description and Uses.

A very light brown coloured timber, with a fairly close, straight grain, with perhaps one or two small gum-veins. It could be used in some cases for the cabinet or joinery trade, and should answer for parts of goods and carriage framing, studs, rafters, joists, fencing and other building purposes.

H. = Moderate. W. = 58 lb. per cubic foot.

TRANSVERSE TEST OF TIMBER.

(The following was made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

Breaking load in lb.	4,760
Modulus of rupture in lb. per square inch ...	10,218
,, elasticity ,, ,, ...	2,789,944
Rate of load in lb. per minute	680

Systematic.

This Eucalyptus was described by Labillardier in his "Plants of New Holland" (1806). The name, *E. amygdalina*, has almost since the beginning of Eucalyptology been associated with the Tasmanian Flora, for it was from Van Dieman's Land that Labillardier obtained his specimens. It does not occur on the mainland of Australia. Thus the trees going under the name of *E. amygdalina* in Tasmania and *E. amygdalina* in Victoria and New South Wales are not the same, the latter being recently described under the name of *E. Australiana*. The abnormal leaves are petiolate, alternate: the normal leaves of the former are smaller and narrower than the mainland *E. Australiana*. The fruits are practically identical in shape with those of *E. dives*, Sch., and not hemispherical as obtains in the mainland *E. Australiana*.

Geographical Range.

Tasmania.

Eucalyptus Australiana. R.T.B. et H.G.S.

"NARROW-LEAVED PEPPERMINT." Plate 89 and Bark Plate 89A.

TIMBER.

DESCRIPTION AND USES.

A pale-coloured, fairly hard, straight-grained timber, somewhat similar to the Ash family in texture, but a little darker in colour. It is a good timber to work, and seasons well. Sometimes has one or two small gum veins near the sap. Could be used for chair and cabinet work, general building purposes, coach and carriage framing, wheelwrights' work and agricultural tool handles. It is one of the timbers sold on the Sydney market as a substitute for American hickory for handles, going under the name of Australian hickory.

H. = Moderate. W. = 50 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	6,950	6,400	7,000
Modulus of rupture in lb. per square inch ...	13,900	12,800	14,000
,, elasticity ,, ,, ...	1,972,602	2,000,000	2,057,142
Rate of load in lb. per minute	580	640	584

Systematic.

It attains great height, probably one of the highest trees in Australia, reaching from 150 to 200 feet, but more often is only an ordinary tree. The bark is persistent on the stem, and well out on the branches. It has what is known as "peppermint" bark, and quite characteristic, being a compact, fibrous nature, but yet distinct from the ordinary "Stringybark." The abnormal leaves are sessile, opposite, cordate-lanceolate; normal leaves narrow lanceolate to broadly lanceolate (Victoria), venation distinct, lateral veins mostly at an angle of about 40 degrees, with occasionally a few at a very acute angle and long spreading intramarginal vein removed from the edge. Flowers in axillary peduncles with a varying number of flowers. Fruit pilular to turbinate, rather small comparatively, from 2 to 3 lines in diameter, with red rim, and a thin contracted edge, valves not exserted.

Geographical Range.

Middle and Southern Coastal ranges of New South Wales and Victoria, but probably extends to Queensland.

PLATE 89.

MESSMATE.

(*Eucalyptus Australiana*, R.T.B. AND H.G.S.)

PLATE 90.

PEPPERMINT.

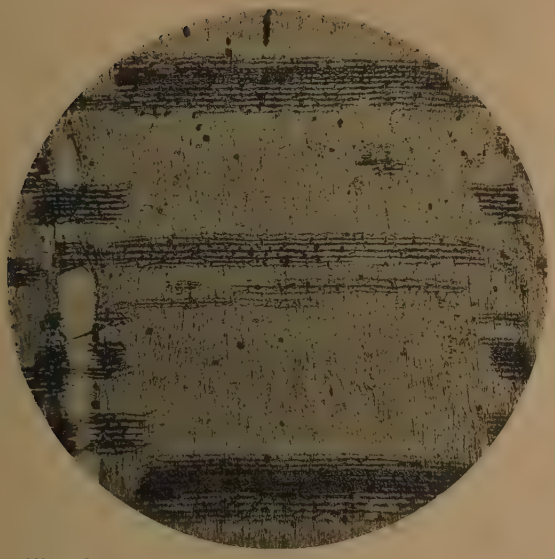
(*Eucalyptus piperita*, SM.)

PLATE 89A.

PEPPERMINT BARK.
(*Eucalyptus Australiana*, R.T.B. ET H.G.S.)

FIG. LVIII.

CROSS SECTION, showing oval pores; rays in irregular lines with parallel fibres.



Micro. photo.

RADIAL SECTION showing rays, and masses of fibres; with a vessel on the left.

[*T. C. Roughley.*

TANGENTIAL SECTION, showing smallness of rays; and portions of vessels.

EUCALYPTUS AUSTRALIANA, R.T.B. ET H.G.S

*Eucalyptus piperita, Sm.

"SYDNEY PEPPERMINT." Plate 90.

TIMBER.

Description and Uses.

It was not the timber that first made this species famous, but its essential oil from which it derives its names, common and botanical.

The species, however, is a fine forest tree, and one to be cultivated, as it flourishes in almost any soil, and produces a very fine hardwood of the Stringybark type, pale-coloured, straight grained, with an occasional gum vein. It planes, dresses, and seasons well, and could be used for carriage work, house building, probably ship's decking, furniture and cabinet work. In some respects it resembles Blackbutt, *E. pilularis*.

H. = Hard. W. = 56 lb. per cubic foot.

TRANSVERSE TEST OF TIMBER.

(The following was made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

Breaking load in lb.	5,890
Modulus of rupture in lb. per square inch ...	13,145
,, elasticity ,, ,, ...	1,750,700
Rate of load in lb. per minute	918

Anatomical Features.

The fibres form a prominent feature, but wood parenchyma and vessels are fairly well represented, whilst rays are numerous. The fibres have rather thick walls being well perforated in the radial walls.

The vessels are divided by septa, almost horizontally placed, the walls being profusely marked with perforations, having slits either longitudinally or slightly obl que.

The rays are almost invariably uniseriate, and a few cells in height, which contain a secretionary substance light in colour—all other elements in this species being free from such. The rays are numerous.

Systematic.

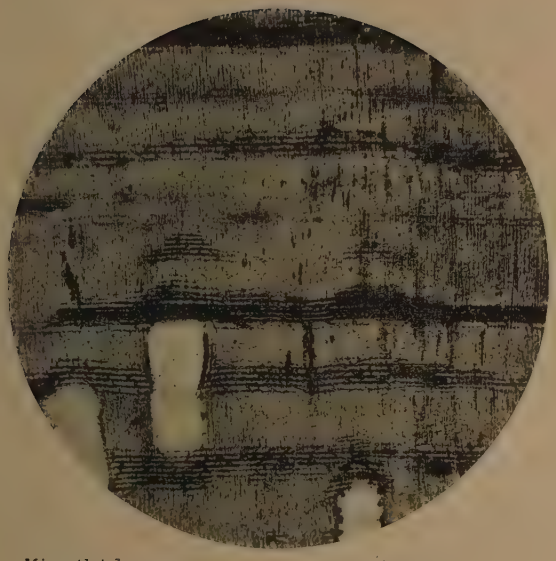
A tall tree, bark fibrous but not so furrowed as in the Stringybarks, hoary on the outer surface. Abnormal leaves ovate, ovate-acuminate, lanceolate, almost membraneous, pale-coloured underneath, 2 to 6 inches long, venation faintly marked, lateral veins oblique, spreading, intramarginal vein slightly removed from the edge. Leaves of mature trees lanceolate, not large, rarely exceeding 6 inches; oblique, not coriaceous, very acuminate, not shining, venation not prominent, lateral veins distinct, oblique, spreading, petiole slender. Fruit pilular, about 3 lines in diameter, sometimes contracted below the rim, when it becomes quite urnshaped; rim thin, valves not exserted.

Geographical Range.

Coast district and tablelands of New South Wales; Victoria; Queensland.

FIG. LIX.

CROSS SECTION, showing regular radial arrangement of fibres, top and bottom portion late wood; pores and wood parenchyma numerous in early wood.



Micro. photo.]

RADIAL SECTION, showing uniform rays with deposit in cells; compact fibres, and portions of three vessels.

[*T. C. Roughley.*

TANGENTIAL SECTION, showing how small, yet numerous, are the rays.

EUCALYPTUS PIPERITA, SM

Eucalyptus linearis, A.Cunn.

"WHITE PEPPERMINT."

TIMBER.

DESCRIPTION AND USES.

A hard, pale-coloured, straight-grained timber, sometimes having very small black spots distributed through it as found in *E. Sieberiana*, "Mountain Ash." As a hardwood it is easy to work, and is suitable for general building purposes. Its durability in the ground is at present unknown.

H. = Hard. W. = 57 lb. per cubit foot.

Systematic.

It is a fairly tall tree, with clean smooth, yellow or whitish bark, sometimes rough for a few feet at the base. Abnormal leaves opposite or alternate, very narrow, mostly 1 line wide and about 2 inches long, on filiform rugose branchlets; only midrib showing, edges thickened. Normal leaves narrow, lanceolate, petiolate, to narrow linear, lanceolate, under 3 inches long and up to ¼ inch wide, not shining, venation hidden in the leaf texture, midrib only showing on the underside, alternate. Peduncles axillary, with few flowers in the head. Buds clavate, operculum depressed, hemispherical. Fruits hemispherical, 3 lines in diameter, slightly shining, on a rather slender pedicel, rim red, scarcely domed, or truncate tips of the valves just exserted.

Geographical Range.

Fairly well distributed throughout Tasmania.

Eucalyptus Andrewsi, J.H.M.

"NEW ENGLAND PEPPERMINT."

TIMBER.

DESCRIPTION AND USES.

This timber is pale coloured, open grained, not much used for general building purposes. Unfortunately it is subject to gum veins and shakes.

H. = Hard. W. = 53 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3
Breaking load in lb.	4,960	4,990	4,660
Modulus of rupture in lb. per square inch ...	9,920	9,849	9,382
,, elasticity ,, ,, ...	1,440,000	1,578,947	1,322,269
Rate of load in lb. per minute	708	623	665

Systematic.

A large tree, with a peppermint bark, having two forms of leaves, abnormal, cordate, sessile, glaucous; and normal, which are broadly lanceolate, venation well marked, lateral veins oblique, indicating a phellandrene oil, the intramarginal vein removed from the edge; occasionally glaucous, but of equal colour on both sides; of the usual size of a Eucalyptus leaf. Fruits inclined to hemispherical, shining, rim thick, valves not exserted.

Geographical Range.

New England, New South Wales.

Eucalyptus Penrithensis, J.H.M.

"PEPPERMINT."

TIMBER.

DESCRIPTION AND USES.

The timber is reddish brown in colour and with concentric, though not abundant, gum veins. (J. H. Maiden.)

Systematic.

A tree of medium height and very scarce locally. Bark hard, fibrous on the trunk, branches smooth, intermediate in character between a "Stringybark" and a "Peppermint." Intermediate leaves petiolate, falcate, acuminate, mostly unsymmetrical, rather coriaceous, equally green on both sides, venation prominent, spreading, intramarginal vein well removed from the edge. Normal leaves much smaller, rather thick, shiny, plentifully besprinkled with black dots, venation resembling those of intermediate leaves. Flowers paniculate, four to ten in the umbel, which has a slightly flattened common peduncle. Anthers kidney-shaped. Fruit hemispherical to nearly pilular, with a well-defined smooth rim, tips of the valves either sunk or not protruding beyond the orifice. The fruit is sharply separated from the filiform pedicel.

Geographical Range.

Penrith district of New South Wales; also said to be found in the Liverpool district.

ASHES.

A RATHER good name as applied to certain Eucalyptus, for it closely describes the character or nature of the timber which much resembles the Fraxinus species of the Northern Hemisphere. Mountain Ash is the more frequent term used, although White and Gully Ash are occasionally given to them.

The name Mountain Ash is, however, associated with several species, such as *E. Sieberiana, E. oreades, E. Delegatensis;* and White Ash, *E. fraxinoides;* and Gully Ash, *E. Smithii*; Cut Tail, *E. fastigata*, and sometimes to *E. virgata.*

SPECIES ILLUSTRATED IN COLOUR :—

E. Delegatensis, R.T.B. (Southern Mountain Ash).
E. fraxinoides, H.D. et J.H.M. (White Ash).
E. virgata, Sieb. (Tasmanian Ironbark).
E. oreades, R.T.B. (A Mountain Ash).
E. Sieberiana, F.v.M. (N.S.W. Mountain Ash).

Eucalyptus Delegatensis, R.T.B.

"A SOUTHERN MOUNTAIN ASH" OR "TASMANIAN OAK." Plate 91.

TIMBER.

DESCRIPTION AND USES.

A straight-grained, fissile timber with the general facies of English Ash when first cut, but tones down in colour, when it acquires quite an Oak appearance. It planes well and is specifically on the light side, but is strong, with a good resilience; a first-class bending timber, and does not warp if carefully seasoned. The tree is a quick grower, and so is one of the best for forest cultivation.

It is a splendid furniture timber, and is extensively manufactured into various articles in this connection in Tasmania and Victoria, where it is also used for Church decoration such as carved screens, office fittings, panelling, &c. It is a good substitute for exotic Ashes or Oaks, and can be utilised for similar purposes to which those timbers are put. It looks well fumed. In the south-eastern parts of New South Wales, at Tumberumba, Mt. Kosciusko, and Delegate, numerous saw mills are engaged cutting this timber alone, as it is in great request in the trade as a building timber and for many other purposes.

PLATE 91.

SOUTHERN MOUNTAIN ASH.

(*Eucalyptus Delegatensis*, R.T.B.)

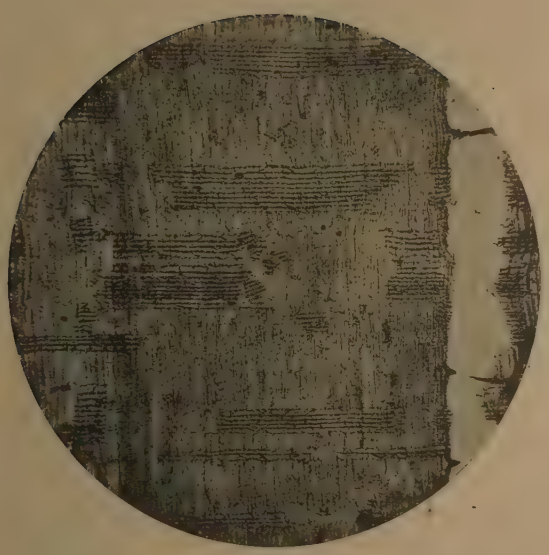
PLATE 92.

WHITE ASH.

(*Eucalyptus fraxinoides*, D. & M.)

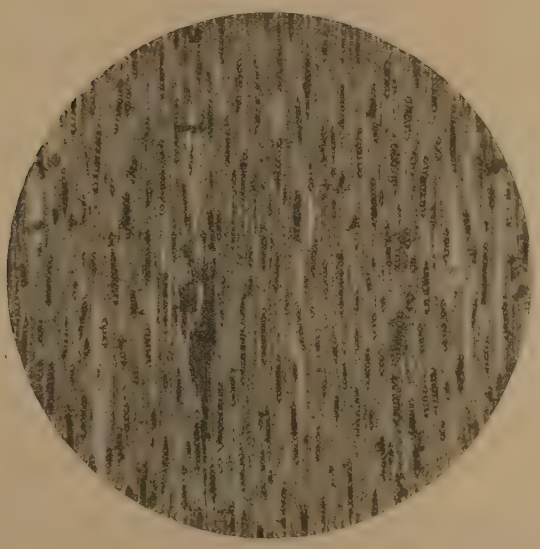
FIG. LX.

CROSS SECTION showing smallness of fibres in comparison with the large thin-walled pores.



Micro. photo.]

RADIAL SECTION, showing fineness of rays; compact body of fibres, and one vessel on the right.



[*T. C. Roughley.*

TANGENTIAL SECTION, showing the numerous, uniseriate rays, a few cells in height.

EUCALYPTUS DELEGATENSIS, R.T.B.

It makes splendid golf sticks (C. W. Chapman), shafts, felloes, spokes, boat oars, agricultural and mining tool handles, and is suitable for carriage work in all its branches.

One of the best Eucalyptus timbers for seasoning well and quickly. A distinguishing feature of this wood is the regular and prominent annual rings, for on a cross section it much resembles a Conifer; only a few other Eucalypts possess this distinguishing character.

The original common name of Ash is now being superseded by that of Oak, as manufactured articles have a great resemblance to that timber, and are exported under the name of " Tasmanian Oak."

H. = Moderate. W. = 41 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	6,810	6,760	6,790
Modulus of rupture in lb. per square inch ...	13,910	13,520	13,314
,, elasticity ,, ,, ...	2,288,000	2,311,000	1,900,000
Rate of load in lb. per minute	490	320	461

ANATOMICAL FEATURES.

The fibres are of two forms, thick walled and small lumen (winter growth) and medium walls with larger lumen (summer growth). These two features are so well defined that in a cross section the annual rings give the wood quite a Conifer appearance—more so than that of any other species of Eucalyptus. The pores are numerous and the wood parenchyma fairly plentiful, whilst the rays are abundant, uniseriate, and a few cells high.

All the wood elements are free from any secretionary deposit. This is one of the few Eucalypts in which tracheids were detected; they occur in the neighbourhood of the vessels.

REMARKS.

Hooker, in his " Flora Tasmaniæ " (1859), gives additional data to his original description of *E. gigantea* (Lond. Journ. of Bot., VI, 479, 1847), and in this additional data he includes two other trees besides his original " Stringybark "—*E. gigantea* (*E. obliqua*). The one he mentions under the name of " Stringybark Gum " (*loc. cit.*) growing up to 4,000 feet altitude is *E. Delegatensis*.

E. obliqua and *E. regnans* grow intermixed at lower elevations, and these are what Hooker evidently refers to in " Flora Tasmaniæ ":— " Specimens have been felled in the valleys at the base of Mt. Wellington."

Hooker's description of *E. gigantea* in his classical work must therefore be regarded as a composite one, and this is well brought out by Maiden in his "Critical Revision of the Genus Eucalyptus" (Vol. I, p. 58), under "*E. obliqua*," and includes this and the two mentioned above, viz., *E. regnans* and *E. Delegatensis*.

This species *E. Delegatensis*, cannot, therefore, be included under *E. gigantea* (a name belonging undoubtedly to *E. obliqua*, as shown by the original description of Hooker in his "London Journal of Botany" (1847), and later by Bentham and Mueller), for it is not the "Stringybark colonorum" of Hooker, which is *E. obliqua*.

For further corroboration of this nomenclature see paper "A research on the Eucalypts of Tasmania," by R. T. Baker and H. G. Smith (Proc. Roy. Soc., Tas., 1912, pp. 183–187.)

Systematic.

A very tall tree, smooth, but occasionally stringy bark, extending well up the trunk. Early leaves large, broadly lanceolate, oblique; venation prominent, spreading, intramarginal vein removed from the edge. Normal leaves comparatively large, often 9 inches long and 2 inches broad, lanceolate, acuminate; venation prominent, lateral veins spreading, intramarginal vein removed from the edge. Peduncles axillary, about 6 lines long, slightly compressed, bearing from six to ten flowers. Buds clavate, 6 to 7 lines long. Operculum hemispherical, obtuse. Calyx short, merging into a pedicel 3 to 4 lines long. Fruit pyriform, about 4 lines long and 3 broad; rim thick, truncate or countersunk. The delightful aroma of herbarium material, even after years of preservation, is quite characteristic of the species.

Geographical Range.

On the high ranges, 4,000 to 8,000 feet, the lower sides of the Snowy Mountains, New South Wales, and Mount Delegate, Victoria, and Tasmanian ranges.

The following should have appeared under E. obliqua, but was inadvertently overlooked:—

Remarks.

Hooker, when he described his species of *E. gigantea* in the "London Journal of Botany" (VI, 479, 1874), was unaware that L'Heritier had described the species under the name of *E. obliqua*, as his (Hooker's) description (*loc. cit.*) applies in every detail to this species, for it is indeed "*the* Stringybark colonorum, and abundant throughout Tasmania," as stated by him, and is to-day *the* "Stringybark" of the island.

When writing his "Flora Tasmaniæ" (1859), Hooker, having in addition to his own, Gunn's and other collectors' material to work upon, included two or three trees under his original name in his classical work. One growing intermixed with *E. obliqua* has since been

separated by Mueller under the name of *E. regnans*, and the other, growing at 4,000 feet elevation, known as "Stringy-bark Gum" or "Gum-topped Stringybark," was described by me in *Proc. Linn. Soc., N.S.W.*, in 1900, under the name of *E. Delegatensis*.

These three trees occur at different altitudes, and the respective species in the above order can be traced in Hooker's two descriptions (*loc. cit.*). Hooker's reference that "trees are felled in the valleys at the foot of Mount Wellington," in his "Flora Tasmaniæ," evidently refers to this species and *E. regnans*, for they only occur on the lower elevations there—the tree of the higher altitudes is *E. Delegatensis* in the same quotation.

Eucalyptus Consideniana, J.H.M.

"WHITE ASH."

TIMBER.

DESCRIPTION AND USES.

A pale-coloured, hard, fairly close-grained, durable timber, somewhat resembling *E. fastigata* in colour, texture, and gum veins. It is easy to work as a hardwood, and should be suitable for general building purposes, coach, waggon and wheelwright's work, fencing and ship-building and probably for casks.

H. = Hard. W. = 58 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	8,760	9,180
Modulus of rupture in lb. per square inch ...	17,520	18,000
,, elasticity ,, ,, ...	2,400,000	2,255,200
Rate of load in lb. per minute	1,251	1,147

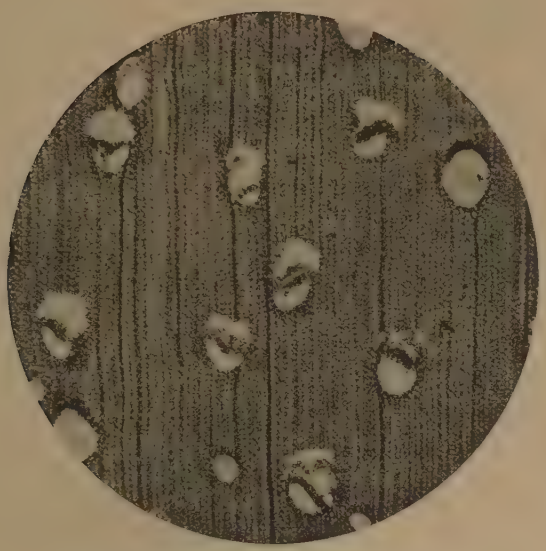
Systematic.

A medium-sized tree, with a field facies of *E. piperita* and *E. virgata*. The leaves, which hang straight down, are rather large for the species, broadly lanceolate, veins pronounced, very oblique, the intramarginal vein well removed from the edge. Inflorescence axillary, peduncles about 1 line long, up to twelve flowers in the umbel. Buds club shaped. Fruits pyriform, about ½ inch long and ½ inch in diamaeter, truncate, the rim red, sometimes sunken; valves very slightly exserted, much resembling those of *E. Sieberiana* and *E. virgata*.

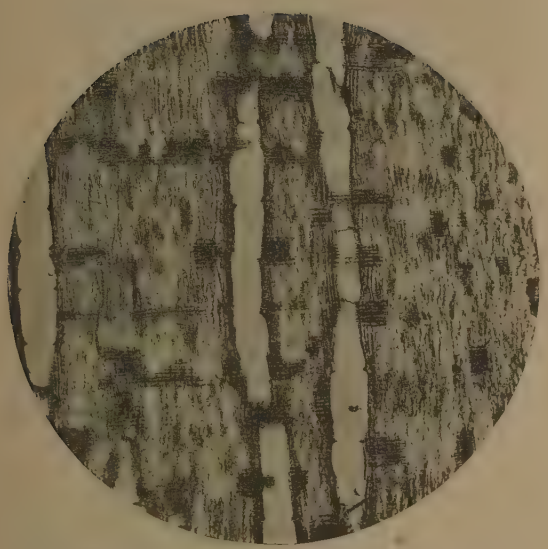
Geographical Range.

Central Coast district and Mountain ranges of New South Wales.

FIG. LXI.



CROSS SECTION, showing great uniformity in size and regularity of fibres; in the pores nearly every wall has broken in the cutting.



Micro. photo.]

RADIAL SECTION, showing masses of fibres separated by vessels.

[*T. C. Roughley.*

TANGENTIAL SECTION, showing end-on view of the very numerous rays amongst the fibres.

EUCALYPTUS FRAXINOIDES, H.D. ET J.H.M.

Eucalyptus fraxinoides, H.D. et J.H.M.

"WHITE ASH." Plate 92.

TIMBER.

DESCRIPTION AND USES.

A splendid tree, deserving of every consideration at the hands of the Forester, as it yields one of the finest timbers of the Ash class amongst the Eucalypts. The timber has all the characters and qualities of the European and American Ashes, being almost white, with a nice sheen, fissile, free working, comparatively light in weight, and suitable for casks, carriage work of all kinds, boat building, decking, in fact every purpose to which lightness, strength and bending qualities are a desiderata.

H. = Moderate. W. = 45 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	9,680	9,370
Modulus of rupture in lb. per square inch ...	18,980	18,740
,, elasticity ,, ,, ...	2,588,500	2,483,900
Rate of load in lb. per minute	1,210	1,171

Systematic.

A tall tree, bark rough half way up the trunk and sometimes the upper part, outer layer falling off in ribbons; the bark blotched. Abnormal leaves alternate, varying from bluntly lanceolate to almost linear-lanceolate, slightly falcate; twigs very glaucous, peduncles flattened. Buds ovoid when young; as growth proceeds the operculum is more or less pointed at the top and thus assumes a conical shape; up to seven or eight flowers in the umbel. Fruits shining, nearly globular, usually seven-sixteenths of an inch in diameter or a little less, urceolate in young fruit, the neck being almost lost in the mature fruit. The rim sharp; the valves usually five and very depressed.

Geographical Range.

Mountains in the Clyde district, Milton, Tantawanglo Mountain, New South Wales.

Eucalyptus virgata, Sieb.

"IRONBARK OF TASMANIA." Plate 93.

TIMBER.

DESCRIPTION AND USES.

This is known in the trade as "Tasmanian Ironbark," but it is not a good name, for its commercial qualities fall below that of the mainland Ironbarks. The presence of gum veins detracts from it to a certain degree, but otherwise it is a close, straight-grained, pale-coloured, hard, fairly heavy timber, with a facies resembling *E. Sieberiana*. It requires careful seasoning, and is suitable for constructional works, carriage and bridge work, and general economic purposes.

H. = Hard. W. = 54 lb. per cubic foot.

PLATE 93.

TASMANIAN MOUNTAIN ASH.
(*Eucalyptus virgata*, SIEB.)

PLATE 94.

SMOOTH BARK MOUNTAIN ASH.
(*Eucalyptus oreades*, R.T.B.)

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	9,820	9,720
Modulus of rupture in lb. per square inch ...	19,640	19,440
,, elasticity ,, ,, ...	2,620,000	2,400,000
Rate of load in lb. per minute	1,227	1,215

Systematic.

An average forest tree, attaining over 100 feet (Rodway), branchlets glaucous. Bark thick, laminated, running down in ridges, friable, but no kino on the outer portion, inner portion hard, close, compact in cross section, the alburnum difficult to determine from the normal wood, inner portion fibrous longitudinally. Abnormal leaves mostly alternate, petiolate, sometimes glaucous, thin, oval-lanceolate to lanceolate, acuminate; venation distinctly marked, lateral veins not very oblique, intramarginal vein removed from the edge, 4 to 5 inches long, up to 1½ inch broad. Leaves comparatively small, rarely 5 inches long, mostly from 2 to 4 inches long, up to ¾ inch broad, lanceolate, shining, subcoriaceous. Venation inconspicuous, lateral veins very oblique, a few running from the petiole, intramarginal vein well removed from the edge. Flowers on axillary peduncles, or in short panicles, operculum hemispherical, shortly acuminate. Fruits pyriform without pedicel, ½ inch long, ½ inch diameter, contracted at the top, rim countersunk.

The difference between *E. virgata*, Sieb., and *E. Sieberiana* are found principally in the smaller leaves, countersunk rim of the smaller fruits, timber, and chemical constituents of the oil of the former. The species are rather difficult to separate by herbarium material alone.

Geographical Range.

Blue Mountains (as a shrub), New South Wales, south through Victoria and South Australia, reaching its greatest height in Tasmania.

Eucalyptus oreades, R.T.B.

"SMOOTH BARK MOUNTAIN ASH." Plate 94.

TIMBER.

DESCRIPTION AND USES.

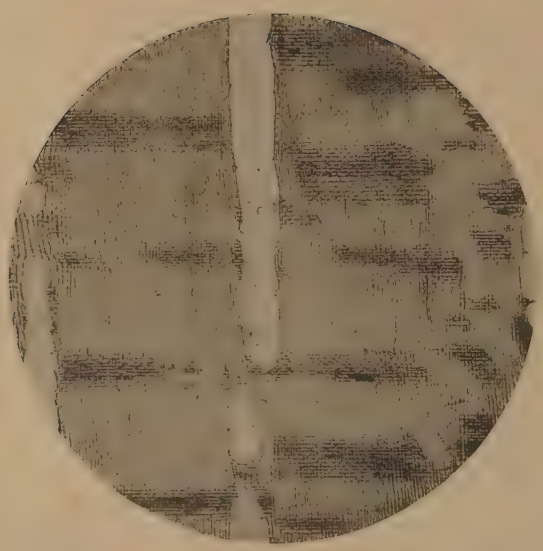
This is one of the most conspicuous trees in the gullies of the Blue Mountains, where, with its tall white, clean-looking stem, it adds considerably to the forest beauty of those parts. Occasionally a few are found on the plateau, as at Katoomba, and the marked tree of the explorers at that spot belonged to this species. As an Ash, this timber is of first-class quality, perhaps equal to *E. Delegatensis*, although a little heavier, and occasionally has a small gum vein. It has all the bending and resilient qualities of European and American Ashes, but is heavier.

It is suitable for house construction, carriage building in all its branches, joinery, cabinet work, and looks well lightly fumed. It has little figure, judging from specimens seen, is fairly hard, tough and straight grained, pale-coloured, almost white, but less so than *E. regnans* and *E. Delegatensis*.

H. = Moderate. W. = 46 lb. per cubic foot.

FIG LXII.

CROSS SECTION, showing a remarkable uniformity of wood elements.



Micro. photo.]

RADIAL SECTION, showing rays with deposit in some of the cells; a vessel in the centre of the picture.

[T. C. Roughley.

TANGENTIAL SECTION.

EUCALYPTUS OREADES, R.T.B.

ANATOMICAL FEATURES.

This is one of, if not, the most open-textured timbers amongst Eucalypts, and not unlike a Conifer in cross section. The fibres have delicate walls and a large lumen, and are most concentrated in the autumn growth, consequently the annual rings are well marked, giving the wood a fine appearance at the cross section. The pores are large and the wood parenchyma is rather numerous but small, and nearly all of the uniseriate variety, and only in some instances is a pale secretion present.

The vessels are numerous and remarkably free from tyloses. This is one of the few Eucalypts in which tracheids were detected.

Systematic.

A tall tree with a smooth whitish bark, or sometimes having a slightly rough bark 6 to 8 feet from the ground. Abnormal leaves thin, elliptical, oval, shortly acuminate on a petiole of about an inch or more; venation more distinct than on mature leaves. Leaves long, often measuring 9 inches thick, shining, dark green on both sides, on rather long petioles, lanceolate, falcate; venation distinct, intramarginal vein removed from the edge, lateral veins very oblique, often approaching the venation of *E. coriacea*. Flowers, few axillary, six to eight in the umbel, calyx-tube hemispherical, rarely pyriform, about 3 lines in diameter, the rim thin, capsule sunk, valves rarely or scarcely exserted.

Geographical Range.

This tree is mostly found at the head of gullies on the Blue Mountains, at the foot of precipitous sandstone cliffs and neighbourhood of waterfalls, or on the edge of pools. It also occurs on the ridges as at Katoomba.

Eucalyptus Smithii, R.T.B.

"WHITE TOP" OR "GULLY ASH."

TIMBER.

DESCRIPTION AND USES.

A hard, pale-coloured, close-grained timber. In colour and texture more resembling White Stringybark, *E. eugenioides*, than the Ash family. The grain is slightly interlocked and a fairly tough timber to plane. The sapwood is attacked by borers. This timber shrinks a good deal in seasoning. When thoroughly dry it is suitable for general rough building purposes, coach and waggon framing and bridge superstructures.

H. = Very hard. W. = 60 lb. per cubic foot.

Systematic.

A tall tree, sometimes attaining a height of 150 feet, and a diameter of 5 feet. Bark on old trees deeply furrowed, and in colour dark grey to blackish. Abnormal leaves sessile, resembling those of *E. radiata* or *E. amygdalina*, lanceolate-cordate, 5 to 6 inches long, not glaucous. Normal leaves narrow, lanceolate, acuminate, of an equal colour on both sides, not shining, venation distinct, lateral veins fine, numerous, spreading, intramarginal vein slightly removed from the edge; petiole about an inch long. Oil glands very numerous. Peduncles axillary, flattened, about as long as the petiole, with numerous flowers, from three to fifteen. Calyx turbinate, narrowing into a short petiole, the whole 3 to 4 lines long. Operculum hemispherical, shortly acuminate. Fruit inclined to be hemispherical in shape, but occasionally pyriform; 2 to 3 lines in diameter, rim domed; valves exserted, obtuse.

Geographical Range.

Southern Coast district of New South Wales.

Eucalyptus Sieberiana, F.v.M.

"MOUNTAIN ASH." Plate 95.

TIMBER.

Description and Uses.

This is a fairly widely distributed species common on the Blue Mountains and the Eastern Coastal ranges generally, extending sometimes to the sea.

It is readily recognised by its rough, compact, deeply-furrowed, dark, flaky bark, and red or livid-coloured terminal branchlets and fairly large leaves. It must not be confounded with the Mountain Ash of the southern ranges and Tasmania (*E. Delegatensis*) from which it differs in the nature of its timber, which is harder, darker in colour, and almost invariably marked with black spots. It is a first-class timber for general building purposes, bridge work, wharves, and heavy coach and carriage work.

H. = Hard. W. = 51 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb	8,470	5,650	8,970
Modulus of rupture in lb. per square inch ...	17,227	11,376	18,060
„ elasticity „ „ ...	2,524,600	2,589,200	2,417,900
Rate of load in lb. per minute	1,210	1,412	1,281

Systematic.

A tall tree with a dark, compact, deeply-furrowed bark. Abnormal leaves oblique, oval, shortly acuminate, and about 3 inches long, or lanceolate falcate, over 6 inches long: venation distinct, lateral veins very oblique, spreading, distinct, the intramarginal vein removed from the edge. Leaves lanceolate, falcate, coriaceous, shining or lusterless venation fairly prominent, and similar to that of abnormal leaves. Flowers on axillary compressed peduncles, 9 lines long, with not many in the umbel. Calyx very short on a pedicel of about 3 lines long. Operculum hemispherical, sometimes with a point. Fruit pear-shaped, mostly about 6 lines long, 3 lines in diameter slightly contracted at the edge, rim flat, thick; valves compressed.

The tree, as now understood, in one of the "Mountain Ashes of the Blue Mountains," the bark extends to the branchlets which are always of a purple colour. The very greatest care is required in order not to confound the herbarium material of this species with a Blue Mountain "Mallee" *E. virgata* (a tall tree in Tasmania), and which has exactly identical foliage and fruits, and cannot, therefore, be differentiated from it by dried specimens, but judged, however, from field observations and chemical results the two are quite distinct.

Geographical Range.

The Blue Mountains and Coast district of New South Wales, South Australia, Victoria.

PLATE 95.

MOUNTAIN ASH.

(*Eucalyptus Sieberiana*, F.v.M.)

PLATE 96.

BLOODWOOD IRONBARK.

(*Eucalyptus Fergusoni*, R.T.B.)

IRONBARKS.

A VERY characteristic group of trees and so named vernacularly on account of the thick, compact, hard bark, but the prefix to the cortical portion of the common name might be equally applied to the wood, for it is certainly the ironwood of the whole genus, and which feature is the principal identification mark of this class of Eucalypts.

The wood is very heavy, hard, compact, and into which it is almost impossible to drive a nail; planes only with difficulty, and for hardness, weight and durability these are the most famous of all the Eucalypts.

Microscopically the fibres are seen to be very thick-walled, compact and closely compressed, and even the wood parenchyma is very substantial compared to that of other timbers.

There are well-marked coloured divisions amongst them, viz. :—

White, grey or chocolate, pink, and red.

SPECIES ILLUSTRATED IN COLOUR :—

E. Fergusoni, R.T.B. (**Bloodwood-bark Ironbark**).
E. crebra, F.v.M. (**Narrow-leaved Ironbark**).
E. siderophloia, Benth. (**Broad-leaved Ironbark**).
E. Nanglei, R.T.B. (**Pink Ironbark**).
E. paniculata, Sm. (**White or Grey Ironbark**).
E. Beyeri, R.T.B. (**Chocolate-coloured Ironbark**).

(*a*) RED TIMBERS.

*Eucalyptus Fergusoni, R.T.B.

"BLOODWOOD IRONBARK." Plate 96.

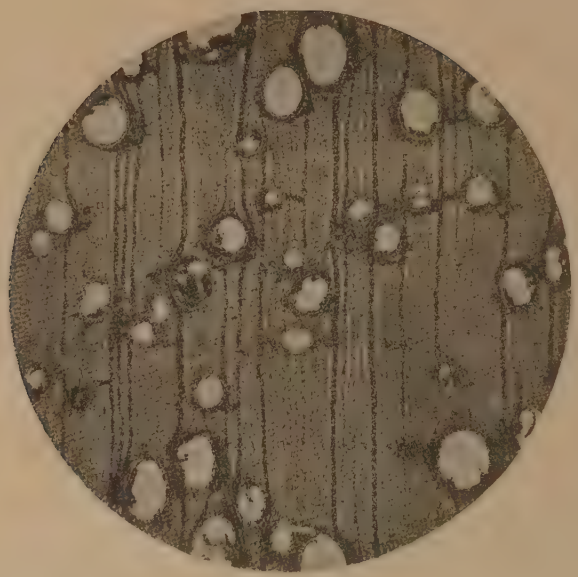
TIMBER.

DESCRIPTION AND USES.

The colour of this timber is mostly a deep red or reddish chocolate when freshly cut, but rather inclined to become a lighter red when aged. It is hard, heavy, straight, or interlocked in the grain, which may be described as rather open, the vessels being conspicuous in a longitudinal cut. Planes and dresses well for an Ironbark. Judging from its texture and several characters, it should be in its economics equal to the very best of the already described Ironbarks, such as *E. crebra*, *E. paniculata*, or *E. siderophloia*. In seasoning it splits with the rings.

H. = Very hard. W. = 72½ lb. per cubic foot.

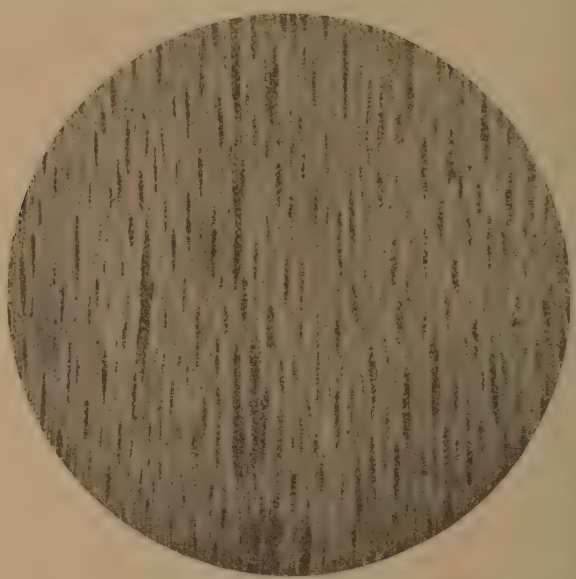
FIG. LXIII.



CROSS SECTION, showing compact radial rows of fibres with small lumen, varying size of the pores, rays with deposit (red) in cells; late wood extending across just below the centre.

Micro. photo.]

RADIAL SECTION showing two big vessels on right, numerous portions of rays, top and bottom left, wood parenchyma with crystals.



[*T. C. Roughley*

TANGENTIAL SECTION, showing numerous rays, and crystal parenchyma.

EUCALYPTUS FERGUSONI, R.T.B.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	11,900	10,830	10,660
Modulus of rupture in lb. per square inch ...	24,452	21,660	21,904
,, elasticity ,, ,, ..	2,887,100	3,130,400	3,261,700
Rate of load in lb. per minute	1,190	1,083	1,066

ANATOMICAL.

A close-textured timber with specially thick-walled fibres, having numerous apertures opening in ovate longitudinal slits, which form a conspicuous feature in a longitudinal section. These fibres are arranged in regular radial rows of varying diameters. The vessels are numerous, with or without tyloses, mostly with. The wood parenchyma is sparse, occurring chiefly in the vicinity of the vessels, with a few scattered amongst the fibres. Ray parenchyma numerous, with a reddish-coloured amorphous substance in the cells; they are nearly all one or two cells wide and a few in height.

Systematic.

A fine, tall, typical specimen of an ironbark, with a facies in the field of a bloodwood, from the nature of the bark, which much resembles those species of Eucalypts. It is probably the thinnest bark of all the ironbarks, and lacks the deep furrows so common to the group, being friable and so very short in the fibre on the exterior half, but hard and compact and deep red in colour for the remaining thickness, there being an entire absence of kino. The abnormal leaves are at first, say, two or three broadly lanceolate, but later leaves much smaller and less coriaceous than the earlier ones; venation distinct, intramarginal vein removed from the edge, lateral veins, medium oblique. Normal leaves lanceolate, falcate, not thick; venation not at all distinct as a rule, intramarginal vein removed from the edge, lateral veins fairly oblique. Inflorescence paniculate-corymbose, but which when developed into the fruiting stage becomes almost corymbose. Calyx pyriform strongly ribbed. Operculum conical, the rim of the calyx bulging beyond the base of it. Fruits pear shaped, on a long slender pedicel strongly four-ribbed, contracted at the flat rim, valves inserted 9 lines long and 4 lines wide.

It is named in honour of his Excellency Sir Ronald Munro Ferguson, P.C., G.C.M.G., Governor-General of Australia, who has given the weight of his great forestry knowledge and experience to the furtherance and advancement of Forestry in Australia.

Geographical Range.

Buladelah, New South Wales.

* Eucalyptus crebra, F.v.M.

"NARROW-LEAVED IRONBARK." Plate 97 and Bark Plate 97A.

TIMBER.

DESCRIPTION AND USES.

One of the finest of the Ironbark timbers, and possessing all the qualities for which this group of Eucalyptus trees are famous. It is close grained, occasionally interlocked, reddish in colour, very hard, heavy, and very durable, for which latter quality it is especially highly prized.

It is in great demand for sleepers, storey-posts, girders, heavy waggon and wheelwright's work, bridgework and wharves.

H. = Very hard. W. = 63 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	9,650	8,000	9,080
Modulus of rupture in lb. per square inch ...	19,300	16,000	18,160
,, elasticity	2,400,000	2,322,500	2,182,600
Rate of load in lb. per minute	1,072	1,000	1,135

ANATOMICAL FEATURES.

A very close-textured timber. In a cross section the fibres are seen to be compact, of rather small diameter, yet thick-walled, with very numerous perforations, seen especially in longitudinal sections, lumen narrow, filled with a deposit; they are regularly arranged in radial rows; the pores are numerous, but comparatively small. The vessels have not a preponderance of tyloses.

The wood parenchyma is scant, mostly found in the neighbourhood of the vessels, and were either empty or filled with a red substance.

The rays are very small and very numerous, from one to two cells wide and only a few in height; the cells are nearly all filled with a reddish deposit. A few specimens of Silica were seen.

Systematic.

This ironbark often grows to a large tree and is the most widely distributed of all the ironbarks, as it occurs on both sides of and on the Dividing Range, as well as in the interior. Its specific characters are distinct, and it is not easily confounded with other ironbarks. The bark is blackish, hard and deeply furrowed. Leaves narrow lanceolate, and mostly under 6 inches long and about ½ inch wide, generally of a thin texture and of equal colour on both sides; lateral veins not well marked, the intramarginal vein not quite close to the edge. Flowers mostly in panicles, appearing to form a terminal corymb. Calyx-tube turbinate, about 1 line diameter. Operculum conical, equal in length to the calyx-tube. Fruit small, under 2 lines in diameter, semi-ovate or sometimes attenuate at the base, rim narrow, contracted; valves not exserted.

Geographical Range.

New South Wales, Queensland, and Northern Australia.

*Eucalyptus siderophloia, Benth.

"BROAD-LEAVED IRONBARK." Plate 98.

TIMBER.

DESCRIPTION AND USES.

A dark, red-coloured timber, with a rather coarse, open, sometimes interlocked grain. Its suitability for works of great strength is well known, and its durability makes it suitable for wharf piles, storey-posts,

PLATE 97.

NARROW-LEAVED RED IRONBARK.
(*Eucalyptus crebra*, F.v.M.)

PLATE 98.

BROAD-LEAVED RED IRONBARK.
(*Eucalyptus siderophloia*, BENTH.)

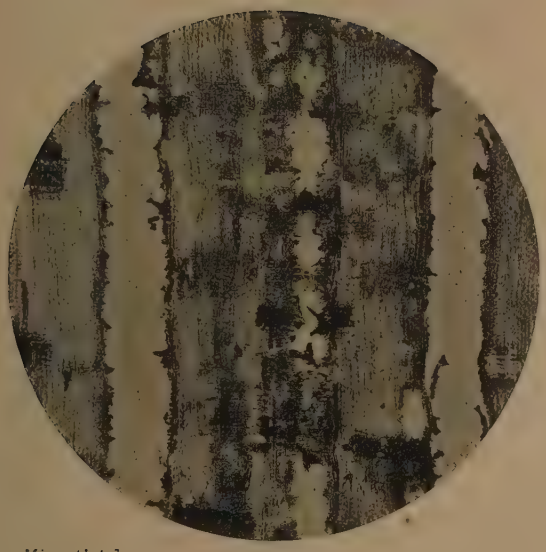
PLATE 97A.

IRONBARK.

(*Eucalyptus crebra*, F.v.M.)

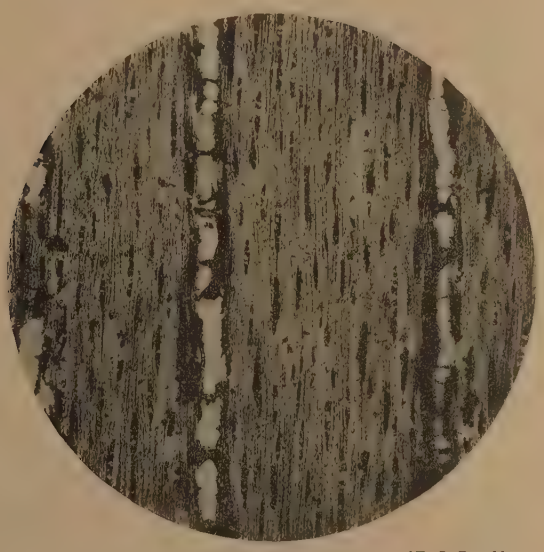
FIG. LXIV.

CROSS SECTION, showing the close compact arrangement of the fibres; numerous pores; and rays (black lines).



Micro. photo.]

RADIAL SECTION, showing compact columns of fibres separated by vessels.



[*T. C. Roughley*

TANGENTIAL SECTION, showing smallness of rays with their deposit. Three vessels blocked with tyloses.

EUCALYPTUS SIDEROPHLOIA, BENTH.

girders, bridge construction, sleepers, heavy waggon work. Specimens of these two latter, presented by the Railway Commissioners, and exhibited in this Museum, show that, in spite of heavy wear and tear, after 25 years constant use, the wood is almost as good as when first used.

H. = Very hard. W. = $72\frac{1}{2}$ lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	11,140	10,870	10,140
Modulus of rupture in lb. per square inch ...	22,280	21,885	21,122
,, elasticity ,, ,, ...	2,571,400	2,501,900	2,551,100
Rate of load in lb. per minute	1,114	1,087	1,126

ANATOMICAL FEATURES.

Like most Ironbarks, the fibres are very thick-walled, but perhaps more so than in most cases of this Group of Eucalypts; they are arranged in regular rows parallel to the rays, the lumen is very small and mostly filled with a fine deposit; the perforations are a distinct feature, being perhaps, larger than in most of the Ironbarks. The pores are comparatively small, and more numerous than in *E. crebra*. The vessels are all plugged with tyloses, and of rather narrow diameter.

The wood parenchyma is fairly prevalent, occurring near or around the vessels, and scattered amongst the fibres; their cells are either empty or filled with a deposit, probably silica, in some cases. The rays are numerous, the cells being filled with a red substance.

Systematic.

This ironbark can be distinguished in the field by its flaky or laminated bark, and broad leaves, especially the abnormal ones.

A tall tree with a deeply furrowed, black bark, which is hard and close in the mature trees, but laminated in the younger ones, and this distinguishes the tree from *E. paniculata*. Abnormal leaves very broad and coriaceous, with a strongly marked venation; mature leaves lanceolate, falcate, variable in size, venation prominent, the intramarginal vein near the edge of the leaf. Oil glands not prominent or numerous. Peduncles axillary or terminal, or in panicles. Calyx angular, turbinate, about 3 or 4 lines in diameter. Operculum long, conical, acuminate or obtuse. Fruit turbinate, angular at the base, under 4 lines in diameter, rim thick, valves blunt, exserted.

Geographical Range.

Distributed along the Middle and Northern Coast districts of New South Wales and Southern Queensland.

Eucalyptus sideroxylon, A.Cunn.

"MUGGA."—"A RED IRONBARK."

TIMBER.

DESCRIPTION AND USES.

A deep red-coloured timber similar to that of *E. crebra*, but rather more open in the grain, and in this respect more resembling that of *E. siderophloia*. It is very hard, strong, and interlocked, but unfortunately this tree has a tendency to pipe, and so big flitches are rarely obtainable.

It is suitable for sleepers, heavy constructional and carriage works, bridges, wharfing, being like most of the group, very durable.

H. = Very hard. W. = 70 lb. per cubic foot.

Systematic.

A tree occasionally attaining a height of 100 feet. Bark persistent, rough, hard, black, very deeply furrowed. Abnormal leaves similar in shape to the normal ones, only slightly smaller. Normal leaves lanceolate, slightly falcate, under 6 inches long: venation indistinct, lateral veins fine, spreading, intramarginal vein removed from the edge. Peduncles slender, axillary, almost 1 inch long. Flowers fairly large, about six in the umbel. Calyx about 3 lines long, elongated on a slender pedicel, from 3 to 4 lines long, 3 lines in diameter. Operculum equal in length to the calyx, conical, obtuse. Fruits elongated, truncate, obovoid, the pedicel lengthening after flowering, 4 lines in diameter, contracted at the edge; rim flat, becoming soon detached—a distinct specific character.

Geographical Range.

The Coast district and interior of New South Wales, and Victoria.

Eucalyptus Caleyi, J.H.M.

"BROAD-LEAVED IRONBARK."

TIMBER

DESCRIPTION AND USES.

Timber a deep red in colour, much esteemed locally and apparently a timber of good quality. (J. H. Maiden.)

Systematic.

A tall ironbark tree, often glaucous, and finally becoming glabrous. Bark very deeply furrowed, and hard. Abnormal leaves nearly orbicular, 3 inches in diameter. The leaves are symmetrical and taper rather abruptly into a petiole of about ½ inch. Texture thick and coriaceous, dull and glaucous. Midrib rather prominent and the intramarginal vein at a considerable distance from the edge. The secondary veins rather prominent and wide apart. Buds, operculum conical and of less diameter than the calyx, which tapers much more than does the operculum. Flowers axillary, becoming terminal by the reduction of the upper leaves, up to seven in the head; the common peduncle rather slender, and about ½ inch in length, each flower on a distinct pedicel. Fruits pear-shaped, slender, tapering into a distinct pedicel, diameter ¼ inch, with a length about twice as great, dark brown and glossy when fully ripe. They have a marked, dark coloured, thin rim such as is common in *E. siderophloia* and *E. melliodora*. Valves well sunk, usually half-way down the capsule.

Geographical Range.

Northern districts of New South Wales, extending north to the Queensland border.

Eucalyptus melanophloia, F.v.M.

"SILVER-LEAVED IRONBARK."

TIMBER.

DESCRIPTION AND USES.

The timber is of a reddish-brown or chocolate in colour, hard, close grained, and heavy. The texture of the timber is more of a "Box" nature than an Ironbark, and appears to be in no way inferior to timbers of that group, and somewhat approaches *E. crebra* in general characters.

The timber could be used for bridge, coach, waggon, wheelwright, wharf and heavy constructional works, and rolling stock.

H. = Very hard. W. = 67½ lb. per cubic foot.

Systematic.

A small tree with a blackish, persistent, sometimes furrowed bark. Leaves glaucous or olive green, sessile, opposite or petiolate, alternate, some cordate-ovate or orbicular to narrow lanceolate, acuminate. Peduncles 2 lines long. Flowers in axillary cymes or terminal corymbs. Calyx-tube slightly angular and of equal diameter. Operculum obtusely conical, shorter than the calyx-tube. Anthers small and globular, cells parallel and distinct. Fruit pear-shaped or globular, about 3 lines in diameter, contracted at the orifice, rim thin, valves not exserted or only slightly so.

Geographical Range.

Western slopes of the Great Divide, and towards the interior of New South Wales and Queensland.

Eucalyptus Staigeriana, F.v.M.

"LEMON-SCENTED IRONBARK."

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey states (Q. Fl., Vol. II, p. 622), "the timber is a rich red, very hard and durable." The stems, however, are frequently pipey. More famous for its citral oil than timber.

Systematic.

A small tree with a dark rugged irregularly fissured bark and glaucous foliage. Leaves obovate to blunt-lanceolate, 2 to 5 inches long, ½ to 2 inches broad, texture thick, lateral nerves erecto-patent, rather close with intermediate anastomising transverse veins, all very slender and obscure from the thickness of the leaf, the intramarginal one very near the edge. Oil-dots copious. Petioles ½ to 1 inch long. Peduncles lateral or axillary, bearing each from three to six flowers, often forming terminal panicles. Operculum conical. Calyx-tube about 1 line diameter. Fruit about 2 lines diameter, and slightly longer. Seeds lenticular.

Geographical Range.

Palmer River, Queensland.

*Eucalyptus Nanglei, R.T.B.

"PINK IRONBARK." Plate 99.

TIMBER.

Description and Uses.

A very fine timber with a distinct clear pink or red colour, and having the facies rather of *E. rostrata*, *E. tereticornis*, or *E. propinqua*, than that of an Ironbark. It may be described as close grained, heavy, hard, but does not plane to so bony a surface as Ironbarks, the fibres having a tendency to lift almost immediately after planing. It is not so heavy as other Ironbarks, probably being the lightest in weight of any of them and not quite so hard as those timbers. Suitable for heavy works of all kinds.

H. = Hard. W. = 69 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	8,850	9,650	10,280
Modulus of rupture in lb. per square inch ...	17,700	19,962	20,837
,, elasticity ,, ,, ...	2,571,400	2,879,700	2,705,000
Rate of load in lb. per minute	1,106	1,206	1,028

Anatomical Features.

A close-textured wood, made up mostly of compact, thick-walled fibres of varying diameters, generally running in a radial direction, the perforations although numerous, are not so conspicuous as in the previous species.

The vessels are fairly numerous, with bordered pits on the walls and mostly plugged with tyloses. The most conspicuous features of the wood are multiseriate bands of wood parenchyma running in the direction of the annual rings; the ray parenchyma is mostly single or double cells in width, and a few cells higher than in *E. Fergusoni*, with a deposit in most of them.

Systematic.

An average forest tree with a very thick, compact, deeply-furrowed bark, containing large quantities of kino. Leaves lanceolate, the early growth leaves might be described as broadly lanceolate, and of a thin texture; lateral veins finely prominent, and not very oblique; usual leaves mostly straight lanceolate, venation not all prominent, lateral veins oblique and more so than in the earlier leaves; intramarginal vein rather close to the edge. Inflorescence paniculate or axillary at the ends of the branchlets, but in the fruiting stage the leaves having fallen the capsules appear in quite a paniculate form. Buds few and pedicel under 1 inch long, calyx pyriform, operculum conical. Fruits inclined to be pilular, constructed to the pedicel, more or less contracted at the rim where it is more or less flat or broad, in some instances slightly ribbed at the base or pedicel, valves not exserted.

This species differs from *E. paniculata*, principally in the physical properties of its timbers, such as colour, texture, also in inflorescence, shape of fruits and nature of bark, and the same remarks apply to other ironbarks. In botanical sequence it may follow *E. Fergusoni*, although the organs differ considerably from that species.

FIG. LXV.

CROSS SECTION, showing fineness of fibres, pores, and numerous rays with coloured deposit.

Micro. photo.]

RADIAL SECTION, showing uniformity of rays; and vessels filled with tyloses.

[*T. C. Roughley.*

TANGENTIAL SECTION, showing several vessels, cut at varying angles; numerous rays in the compact body of fibres.

EUCALYPTUS NANGLEI, R.T.B.

PLATE 99.

PINK IRONBARK.
(*Eucalyptus Nanglei* R.T.B.)

PLATE 100.

WHITE IRONBARK.
(*Eucalyptus paniculata*, SM.)

It is named after Mr. J. Nangle, Superintendent of Technical Education, to whom the author is much indebted for many of the timber tests herein given, and who has also worked upon the technology of architectural Australian timbers.

Geographical Range.

It has a wide range preserving its specific features fairly well throughout its distribution. Localities at present known are Morisset, Wyong, Nowra, Lindfield, and Sydney district, north and south.

(*b*) PALE TIMBER.

*Eucalyptus paniculata, Sm.

"WHITE," "BLACK," OR "GREY IRONBARK." Plate 100.

TIMBER.

DESCRIPTION AND USES.

The colour, the first feature to be taken into account in determining this species, ranges from the very palest to a light grey or light chocolate. When first cut it is white, and in some instances remains so, but mostly on exposure darkens to a grey or light chocolate, never pink or red. It is straight in the grain, fairly fissile for an Ironbark, strong, heavy, compact in texture, durable and suitable for all kinds of heavy constructional, heavy carriage and waggon works, spokes, naves, &c. It was one of the first to be used by the earliest settlers in the neighbourhood of Port Jackson, for bridging, house building, piles, and generally where great strength and durability were required.

The Black Ironbark of Port Macquarie often has a number of black narrow or broad streaks running through its timber.

It is perhaps the most ornamental tree of the Ironbarks, and looks well in streets, and is one of the first trees that should be cultivated in any scheme of afforestatiom.

(White) H. = Very Hard. W. = 64 lb. per cubic foot.
(Black) H. = Very Hard. W. = 69½ lb. per cubic foot.
(Grey) H. = Very Hard. W. = 63½ lb. per cubic foot.

WHITE IRONBARK.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	10,310	10,250	10,530
Modulus of rupture in lb. per square inch ...	21,475	20,847	21,490
,, elasticity ,, ,, ...	3,240,000	3,076,000	3,023,300
Rate of load in lb. per minute	1,031	1,025	1,053

BLACK IRONBARK.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	9,160	9,320	9,900
Modulus of rupture in lb. per square inch ...	18,320	19,150	19,800
,, elasticity ,, ,, ...	2,250,000	2,618,300	2,675,200
Rate of load in lb. per minute	1,017	1,165	1,100

GREY IRONBARK.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	9,850	8,910	7,800
Modulus of rupture in lb. per square inch ...	19,700	17,820	16,848
,, elasticity ,, ,, ...	3,716,129	3,456,000	2,419,200
Rate of load in lb. per minute	820	891	1,114

Anatomical Features.

A very uniformly-textured timber, the fibres are thick-walled, with many perforations, and arranged in regular compact radial rows. The pores are very numerous, filled with tyloses and occasionally a dark brown deposit.

There appears to be an almost entire absence of wood parenchyma, only two or three being seen at the bottom of the section. The numerous rays are mostly uniseriate and a few cells high; nearly all the cells contain a brown deposit, especially seen in the dark radial lines of a cross section.

Systematic.

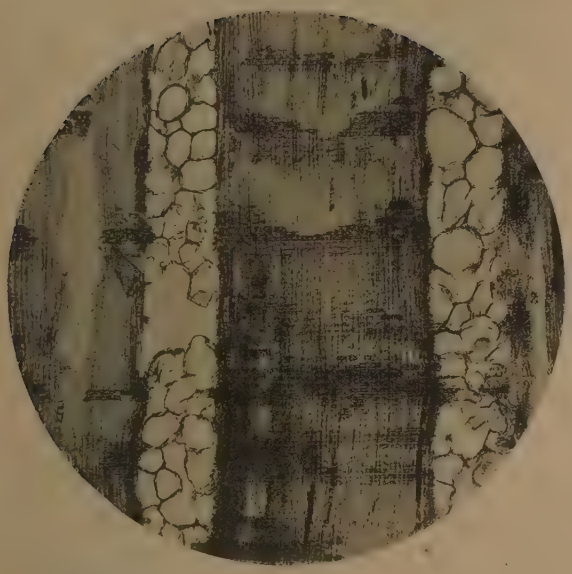
A large forest tree with a grey or black coloured, deeply-furrowed, corky, thick bark, permeated, more or less, with kino, except the inner portion which is very close and compact, almost as hard as the wood itself. Leaves practically uniform, lanceolate, the abnormal leaves broadly lanceolate, earlier two or three inclined to ovate; marginal vein removed from the edge, although in some cases quite close to the edge, venation oblique, but more marked than in the normal leaves, which have quite indistinct veins. Inflorescence paniculate. Operculum conical, either longer or shorter than the calyx, which varies from pyriform to slightly hemispherical. Fruits truncate, pyriform, urn-shaped, or inclined to hemispherical; the pyriform shaped capsule varies in length; from 3 to 4 lines, and under 3 lines in diameter, slightly less in the other forms; in the former the rim flat, raised, the outer edge and valves well exserted. When the timber is white the fruits have a raised ring at the edge.

Geographical Range.

Middle Coast districts of New South Wales and north to Southern Queensland.

FIG. LXVI.

CROSS SECTION, showing the compact, yet regular radial rows of fibres with exceedingly small lumen; pores numerous.



Micro. photo.]

RADIAL SECTION, with mass of fibres in the field of the rays; two vessels closed with tyloses.

[*T. C. Roughley*

TANGENTIAL SECTION, showing rays with deposit; two vessels plugged with tyloses.

EUCALYPTUS PANICULATA, SM.

(*c*) CHOCOLATE-COLOURED TIMBER.

*Eucalyptus Beyeri, R.T.B.

[Syn : *E. paniculata*, var. *angustifolia* : Woolls.]

"NARROW-LEAVED IRONBARK." Plate 101.

TIMBER.

DESCRIPTION AND USES.

A dark chocolate-coloured, close-grained timber, mostly interlocked, heavy, very hard, and having a great reputation for durability, and so is one of the finest Ironbarks of the country.

It could be used for all kinds of heavy constructional works, such as bridges, wharves, beams, posts, heavy carriage and coach work.

It is a valuable timber and not easily confounded with any other yet described. Like *E. paniculata* its great qualities were early recognised in the first days of the Colony.

H. = Very hard. W. = 71½ lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	8,570	8,980	8,000
Modulus of rupture in lb. per square inch ...	17,854	18,080	16,216
,, elasticity ,, ,, ...	2,234,400	2,271,000	2,164,800
Rate of load in lb. per minute	1,071	1,122	1,000

ANATOMICAL FEATURES.

A cross section of this timber reveals an unusually large number of pores for so hard and heavy a timber, and showing a great variation in diameter. Tyloses appear to be common to most of the vessels.

The fibres are closely packed, almost compressed, running mostly in radial lines, very thick-walled, with numerous perforations—ovate in outline and at regular intervals in the axis of this element. The lumen contains a dark deposit as well as the wood parenchyma, which is sparse and scattered irregularly amongst the wood elements. In a few cells crystals were detected. The rays are numerous and two cells wide and a few in height, and most of the cells contain a brown deposit.

PLATE 101.

NARROW-LEAVED OR CHOCOLATE-COLOURED IRONBARK.

(*Eucalyptus Beyeri*, R.T.B.)

PLATE 102.

BRUSH BOX.

(*Tristania conferta*, R.Br.)

Systematic.

A tree with a tall, giant stem, surmounted with rather a straggling sparsely leaved head. Bark hard, heavy, very thick, permeated with kino. Leaves lanceolate throughout, those of the early stage very narrow-lanceolate, thin, almost membraneous, average foliage leaf wide in proportion to the length, not thick, the base tapering and evenly balanced, oblique or rounded. Venation in some cases well marked. Buds small, calyx tapering into a proportionately long and slender pedicel: operculum conical. Fruits pyriform, shining, pedicel slender, rim thin, valves attached at the base below the rim, not exserted.

In general features such as leaves, buds, fruits, it very closely approaches *E. crebra*, and from herbarium material alone might easily be mistaken for *E. crebra*, but the timber at once readily differentiates it from that species.

Geographical Range.

This tree seems rather restricted in its geographical range, being so far only recorded from Kingswood, St. Mary's, N.S.W.

Eucalyptus drepanophylla, F.v.M.

THIS is a Queensland species, but there appears to be very little data concerning its timber.

Additional Eucalyptus Species.

THE following Eucalypts have recently been described, but the economics of their timbers appear to be little known:—

E. BLAKELYI	J.H.M.	N.S.W.	
E. CONFLUENS	,,	Q.	
E. DUNDASII	,,	W.A.	A tall forest tree of Dundas, W.A.
E. FLOCKTONIÆ	,,	W.A.	
E. GILLII	,,	S.A.	
E. HÆMATOXYLON	,,	W.A.	
E. HOUSEANA	,,	W.A.	Amongst the tallest of tropical species, occasionally reaching 80 ft.
E. KYBEANENSIS	,,	N.S.W.	
E. MOORIANA	,,	W.A.	
E. MOOREI	,,	N.S.W.	
E. NEGLECTA	,,	Vic.	
E. PIMPINIANA	,,	S.A., W.A.	
E. SHEATHANA	,,	W.A.	
E. SCOPARIA	,,	N.S.W.	
E. SIMILIS	,,	Q.	
E. STRICKLANDI	,,	W.A.	
E. WEBSTERIANA	,,	W.A.	
E. BANCROFTI	,,	N.S.W.	

Tristania neriifolia, R.Br.

"WATER GUM."

TIMBER.

DESCRIPTION AND USES.

This is one of the few hardwoods, non-Eucalypt, that possesses a deep red-coloured timber with a strip of about 2 inches of grey colour on the outside. It is very close grained, and can be worked up to a nice surface, whilst the texture generally approaches some of the Laurineæ. It is very suitable for panelling, carving, turning, tool handles, mallets, spokes, coach and carriage framing, boat building, and various other uses requiring a strong, tough timber.

H. = Hard. W. = 61½ lb. per cubic foot.

Systematic.

A medium-sized tree, glabrous, or the young shoots and under side of the leaves minutely glaucous-pubescent. Leaves opposite, lanceolate, acute, narrowed into a short petiole, nerveless except the prominent midrib, 1½ to 3 inches long. Flowers yellow, in opposite axillary cymes, but forming usually a terminal corymb, the central shoot not growing out till after the flowering. Calyx tube turbinate, five-angled 1 to 1½ line long, lobes ovate, as long as the tube. Petals often above 2 lines long. Fruiting calyx about 2 lines long, the capsule much shorter. Seeds not seen.

Geographical Range.

Port Jackson, Blue Mountains, and Illawarra district, New South Wales.

Tristania suaveolens, Sm.

"SWAMP TURPENTINE."

TIMBER.

DESCRIPTION AND USES.

It is exceedingly difficult to differentiate this timber from its congeners—*T. neriifolia* and *T. laurina*, and the descriptions given under those species apply equally well to this wood, except that the colour is less red and rather more chocolate. It is, in appearance, very like the genuine Turpentine, *Syncarpia laurifolia*, except that it is slightly darker in colour, but is easily mistaken for it, and, doubtless, is often supplied and used unknowingly in lieu of the real article.

H. = Moderate. W. = 54½ lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timbers of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	4,870	4,920
Modulus of rupture in lb. per square inch ...	9,470	9,840
,, elasticity ,, ,, ...	1,208,200	1,107,600
Rate of load in lb. per minute	974	984

Systematic.

A tree, more or less glaucous or hoary, or the young shoots hirsute, rarely quite glabrous. Leaves alternate, petiolate, ovate-elliptical, ovate-lanceolate or elliptical-oblong, obtuse or acuminate, more or less distinctly penniveined and reticulate, in some specimens 1¼ to 3 inches, in others 3 to 6 inches long. Flowers usually small, in axillary cymes, the common peduncle ¼ to ½ inch long, more or less flattened. Calyx-tube campanulate, usually hoary-pubescent, 1 to 1½ line long; lobes very short and broad. Petals 1½ line diameter. Fruiting calyx very open, 2 to nearly 4 lines diameter, the capsule not exceeding the tube. Seeds linear-cuneate, not winged; cotyledons rather broad and folded.

Geographical Range.

Coastal districts from northern New South Wales to the Gulf of Carpentaria.

*Tristania conferta, R.Br.

"BRUSH BOX." Plate 102.

TIMBER.

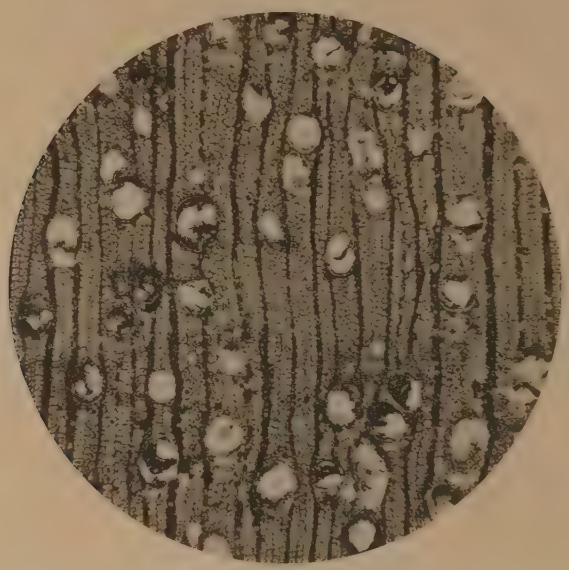
DESCRIPTION AND USES.

This is a large brush tree, found in the coast districts of New South Wales. The timber is close-grained, hard, heavy, and tough, with no distinct figure; is liable to warp and twist, and very difficult to season. It is largely used for bush tram rails in the northern district, also for wood-blocking (but is not a favourite), and for ships' planking. This is one of the best hardwoods for making mauls or mallets, and, when thoroughly dry, could be used for heavy rolling stock, coach and wheelwright's work, bridgework, wharf superstructure, and various purposes in house construction; one of the best timbers for large lifting wedges, such as those used in shipbuilding yards; much esteemed for wharf decking. It is said to resist the attack of white ants.

A splendid tree for street planting, for which purpose it is now extensively used in the suburbs of Sydney.

H. = Moderate. W. = 54 lb. per cubic foot.

FIG. LXVII.



CROSS SECTION, showing the rays in wavy black lines, the compact rows of fibres with small lumen, and numerous pores plugged with tyloses.

Micro. photo.]

RADIAL SECTION, showing the difficulty of cutting a true radial view, owing to wavy disposition of the fibres; portions of vessels are also seen.

[*T. C. Roughley*

TANGENTIAL SECTION: the vessels are seen to be plugged with tyloses.

TRISTANIA CONFERTA, R.BR.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timbers of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	6,640	6,830	10,000
Modulus of rupture in lb. per square inch ..	13,017	13,660	20,000
,, elasticity ,, ,, ..	.....	1,752,484	2,938,775
Rate of load in lb. per minute	510	621	666

Systematic.

A tall tree, with a smooth, brown, deciduous bark and dense foliage, the young shoots often clothed with spreading hairs, otherwise glabrous, except the inflorescence, the buds of the succeeding year covered with large imbricate coloured scales. Leaves alternate, crowded at the ends of the branches so as to appear verticillate, petiolate, ovate or ovate lanceolate, acuminate or rarely almost obtuse, usually 3 to 6 inches long, penniveined and minutely reticulate underneath. Flowers in cymes of three to seven, usually on the young wood below the cluster of leaves, the floral leaves mostly abortive, the peduncle flattened, ¼ to ½ inch long, or rarely elongated. Calyx-tube more or less pubescent or hirsute, turbinate, 1½ to near 3 lines long; lobes narrow, acute, nearly as long as the tube. Petals undulate, often 3 lines diameter. Fruiting calyx 3 to 4 lines diameter, hemispherical or cup-shaped, truncate, smooth, the capsule level with the orifice or shortly exceeding it. Seeds linear-cuneate, not winged; cotyledons folded.

Geographical Range.

Coastal districts, Northern Australia to Northern New South Wales.

*Tristania laurina, R.Br.

"WATER GUM." Plate 103.

TIMBER.

DESCRIPTION AND USES.

This is a well known timber in the hardwood trade, being much appreciated for certain specific uses. The colour is a pinkish grey, dark red towards the centre, and similar in texture to *Tristania neriifolia*, but is difficult to distinguish from that timber, except for its less red colour. It requires to be carefully seasoned, otherwise it shows a tendency to split; when thoroughly dry it could be used for the same purposes as *Tristania neriifolia*.

H. = Hard. W. = 60 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timbers of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	4,400	7,840
Modulus of rupture in lb. per square inch ...	9,686	17,496
,, elasticity ,, ,, ...	2,011,500	2,135,900
Rate of load in lb. per minute	880	980

Systematic.

A tree attaining in moist situations a great height, the young shoots more or less glaucous or silky-pubescent, especially the under side of the leaves, the older foliage glabrous. Leaves alternate, lanceolate elliptical or obovate-lanceolate, acuminate, penniveined, 2 to 4 inches long, narrowed into a petiole. Flowers yellow, in short axillary cymes, on a very short common peduncle, the pedicels rarely longer than the calyx. Calyx-tube broadly campanulate, 1½ to 2½ lines diameter, lobes small, triangular, distant at the time of flowering although imbricate in the young bud. Petals 1½ to 2 lines long, usually undulate. Capsule obovoid or almost globular, 3 to 5 lines diameter, adnate at the base only, filling the calyx-tube and protuding considerably beyond it.

Geographical Range.

Blue Mountains and Coastal districts of New South Wales; banks of rivers, Gippsland, Victoria; and southern localities, Queensland.

*Syncarpia laurifolia, Ten.

"TURPENTINE." Plate 104 and Bark Plate 104A.

TIMBER.

DESCRIPTION AND USES.

This tree is easily determined in the field by its gregarious habit and mostly also by its cluster of stems, pale underside of the leaves, and adnate fruits from which it derives its generic name.

The timber is of a dark, undecided brown colour, tough, hard, and close grained, and in texture and grain not unlike some of the Red Ironbarks. Specially used for piles, as it is stated to resist the attack of the teredo longer if left with the bark on, the inner layer containing a resin is not relished by animal life, nor do these pests attack the dark-coloured heartwood. Also used for girders and pillars. Very abundant on the coast. Grows to a large tree.

H. = Hard. W. = 63 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timbers of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	8,730	8,590
Modulus of rupture in lb. per square inch ...	17,936	18,960
,, elasticity ,, ,, ...	2,223,000	2,387,400
Rate of load in lb. per minute	1,091	1,118

ANATOMICAL FEATURES.

The salient feature in the wood elements of this species is the unusually large number and size of the wall perforations in the fibres. The fibres are fairly regularly arranged in radial lines, with medium thick walls, a lumen measuring about a third of the whole diameter. The vessels are numerous, mostly empty; the rays are also numerous and almost invariably of the uniseriate type, most of the cells containing an amorphorus substance. A few tracheids were noted in the outer rows. Wood parenchyma was rare.

PLATE 103.

WATER GUM.

(*Tristania laurina*, R.BR.)

PLATE 104.

TURPENTINE.

(*Syncarpia laurifolia*, TEN.)

PLATE 104A.

TURPENTINE BARK.

(*Syncarpia laurifolia*, TEN.)

[The resin in this bark is shown in the black markings at the top of the plate.]

Systematic.

A brush tree, the young shoots and under side of the leaves more or less hoary-pubescent or glaucous. Leaves appearing sometimes in whorls of four from two pairs being close together, from broadly ovate to elliptical-oblong, obtuse or obtusely acuminate, glabrous above 2 to 3 inches long, on petioles of ¼ to ½ inch. Flowers white, united, six to ten together in globular heads, on peduncles of ½ to 1 inch at the base of the new shoots, with two to four bracts close under the head either short and scale-like or leaf-like and exceeding the flowers. Calyxes connate at the base, the free parts broadly campanulate, softly hoary-pubescent, 1 to 1½ line long, lobes short, broad, and obtuse. Petals broadly ovate or orbicular, about 1½ line long. Fruiting heads about ½ inch diameter, the calyxes connate to about the middle.

Geographical Range.

Blue Mountains and Coastal districts of New South Wales.

Syncarpia leptopetala, F.v.M.

"BRUSH TURPENTINE."

TIMBER.

DESCRIPTION AND USES.

A hard, fairly close-grained, dark reddish-brown timber, similar to *Syncarpia laurifolia* in many respects, and in some specimens very difficult to distinguish from that timber, but is, perhaps, a little more open in the grain, and appears on the end section to be a faster growing tree. It should be suitable for the same purposes as *Syncarpia laurifolia*.

H. = Hard. W. = 62 lb. per cubic foot.

Systematic.

A tree of 50 to 60 feet, the young shoots, under side of the leaves, and inflorescence minutely and closely tomentose or almost scurfy, or at length glabrous, the young branches angular. Leaves ovate-elliptical or ovate-lanceolate, acutely acuminate, penniveined, glabrous above, 2 to 4 inches long, tapering into rather short petioles. Flowers small and numerous, in dense globular heads but quite free from each other, the common peduncles slender, 1 to 1½ inch long, in terminal clusters or panicles. Bracts very small, linear or lanceolate. Calyx-tube pubescent or nearly glabrous, membranous, turbinate-campanulate, 1 to 1½ line long; lobes short, rounded. Petals narrow, ¾ line long.

Geographical Range.

Coastal brush forests of Queensland and New South Wales.

*Syncarpia Hillii, Bail.

A "TURPENTINE."

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey (Q. Fl., Vol. II, p. 639) refers to the wood as dark-pink colour, close in the grain, tough and durable, and a useful building timber.

Geographical Range.

Fraser's Island.

Xanthostemon pachyspermus, F.v.M. et Bail.

A "YELLOW WOOD."

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey (Q. Fl., Vol. II, p. 642) records of this tree that the wood is of a grey colour, fine in the grain, tough and strong.

Systematic.

A glabrous tree of medium size, the leaves alternate but often crowded at the ends of the shoots and so close as to appear opposite, petiolate, ovate-lanceolate, at times very obtuse but always much tapered towards the base, 3 to 5 inches long, penniveined, with the primary lateral veins rather distant and prominent. Flowers in slender often raceme-like panicles, 2 to 3 inches long, in the upper axils, on slender pedicels. Capsules somewhat glabose, more than half superior, $\frac{1}{2}$ to $\frac{3}{4}$ inch diameter, opening in three hard valves, rugose on the back.

Geographical Range.

Johnstone River, Queensland.

Xanthostemon oppositifolius, Bail.

"SOUTHERN PENDA." Plate 105.

TIMBER.

DESCRIPTION AND USES.

A very dark-brown, almost black, timber, resembling *Juglans regia*, "Walnut," both in colour and figure, but is much closer in the grain. It is very hard and difficult to work. There appears to be some differences of opinion concerning its economics, for F. M. Bailey states (Q. Fl., Vol. II, p. 642) "that the wood is indestructible except by fire, and is suitable for all kinds of bridge building, for piles, girders, headstocks, &c., or, in fact, any work where great strength and durability are essential," whilst Mr. W. D. Francis, of Queensland, to whom I am indebted for specimens of this timber, informs me that "it is popularly known as 'Penda,' but is not widely distributed, being very probably confined to Noosa and a few districts immediately surrounding it. In the localities where it is found it is very abundant, developing into large trees about 120 feet in height, and up to 4 or 5 feet in trunk diameter. The timber is remarkably hard, harder in fact than that of any of the Eucalypts I have observed. After some seven years' experience in a locality where the tree is especially abundant, I cannot confirm assertions as to the durability of the timber and its suitability for purposes where it is in contact with the ground. As regards bridgework I can inform you of an experience in that particular connection where the use of the

PLATE 105.

PENDA.

(*Xanthostemon oppositifolius*, BAIL.)

PLATE 106.

GREY MYRTLE.

(*Backhousia myrtifolia*, HK.f. AND HARVEY.)

timber for bridge building resulted in its failure to last, and caused the local authority considerable expense in replacing it with durable material. When this district was opened up some eight or nine years ago, the Department of Lands made a road into it. As the country was almost entirely of dense scrub where hardwood was absent, 'Penda,' being a very hard timber, was used for the bridges. Within the past three years it has been found necessary to replace all of them with durable structures. Besides these evidences of its lack of durability in contact with the ground, we have had several experiences with similar results around our home. But where it is susceptible to decay in the ground, it is probably a very good timber to last under other conditions, and there are, perhaps, several economic uses where the timber with its remarkable properties could be employed with advantage."

H. = Extremely hard. W. = 71 lb. per cubic foot.

Systematic.

A large tree, glabrous except the inflorescence and perhaps the early growth, forming a barrel of 40 to 50 feet, with a diameter up to 4 feet. Leaves opposite or here and there very rarely alternate ovate-oblong, very obtuse, slightly tapering at the base, 2 to 4 inches long, 1 to 2½ inches broad, rather thick, on petioles of from ½ to 1 inch long, the primary veins rather close and parallel, joining far within the margin, the finer reticulation close and prominent in the dried leaf. Oil-dots small but numerous, hidden to the unassisted eye by the thick texture of the leaf. Peduncles ½ to 1 inch long in the upper axils, usually bearing a cyme of three or four pedicellate flowers. Bracts small, falling off from the early inflorescence. No flowers collected. Capsule nearly globular, about ½ inch diameter, seated on the base of the expanded four or five blunt-lobed calyx, opening loculicidally in three hard valves, the epicarp usually separating from the endocarp in each valve, the placenta prominent and spuriously dividing the cells. Seeds numerous.

Geographical Range.

Noosa, Queensland.

Xanthostemon pubescens, C. T. White.

"ATHERTON PENDA."

TIMBER.

DESCRIPTION AND USES.

Mr. N. W. Jolly states that this tree in the Atherton scrubs attains a diameter of 8 feet, and that the wood is pink in colour, with a curly grain, and is the most esteemed of local hardwoods for structural purposes. It is not subject to insect attacks, and, though showing superficial cracks, does not split when seasoning.

Systematic.

A large tree, branchlets, inflorescence and under-surface of the leaves pubescent. Leaves lanceolate, average 4½ inches long, 1½ inch wide, apex bluntish, base tapering into a petiole of about ¾ inch, under-surface thinly pubescent, denser on the petioles and main nerves, upper surface glabrous or glabrescent with the exception of the midrib, which is more or less densely pubescent in the lower half. Flowers in terminal or subterminal pedunculate crowded cymes, peduncles up to 6 lines, peduncles, pedicels and calyxes densely beset with light-brown hairs. Calyx-tube broadly campanulate, 3 lines diameter, lobes triangular, ovate, 2 lines long. Petals glandular-dotted, densely tomentose, shortly exceeding the calyx-lobes. Stamens numerous (apparently shorter than *X. chrysanthus* but not seen in perfect condition). Ovary glabrescent. Capsule nearly globular, 6 lines diameter, three-celled, seated on the flattened and enlarged calyx-tube.

Geographical Range.

Herberton and Atherton districts, Queensland.

*Backhousia myrtifolia, Hook.f. et Harv.

"GREY MYRTLE." Plate 106.

TIMBER.

DESCRIPTION AND USES.

A hard, tough, very close, straight-grained timber of a pinkish-grey colour, with a narrow dark-brown centre. It is a fine timber right out to the bark, and useful for constructional and heavy carriage work, pillars, beams, girders, and also suitable for chisel handles, mallets, wheelwright's work, turnery, and wood screws. Altogether, like its congener, a tree that should be reafforested.

H = Very hard. W = 65½ lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	10,320	9,580	11,020
Modulus of rupture in lb. per square inch ...	21,783	20,296	23,108
,, elasticity ,, ,, ...	2,782,400	3,103,400	3,156,800
Rate of load in lb. per minute	1,032	1,197	1,102

Systematic.

A brush tree, the young shoots and the underside of the leaves and the inflorescence more or less pubescent or softly hirsute, the older foliage glabrous. Leaves ovate, acutely acuminate, penniveined, 1 to 2 inches long, narrowed into a petiole of 1 to 2 lines. Flowers white, in small cymes sometimes contracted into heads, on peduncles of ¾ to 1 inch at the base of the new shoots, forming terminal leafy panicles. Bracts narrow, falling off long before flowering. Calyx-tube turbinate, softly pubescent or rarely glabrous, nearly 1½ line long, lobes from ovate-oblong to lanceolate, petal-like but rigid, 2 lines in large flowered forms 3 lines long. Petals not half so long. Fruit enclosed in the calyx-tube, but not seen ripe.

Geographical Range.

Northern districts of New South Wales, to Pine River, Queensland.

*Backhousia sciadophora, F.v.M.

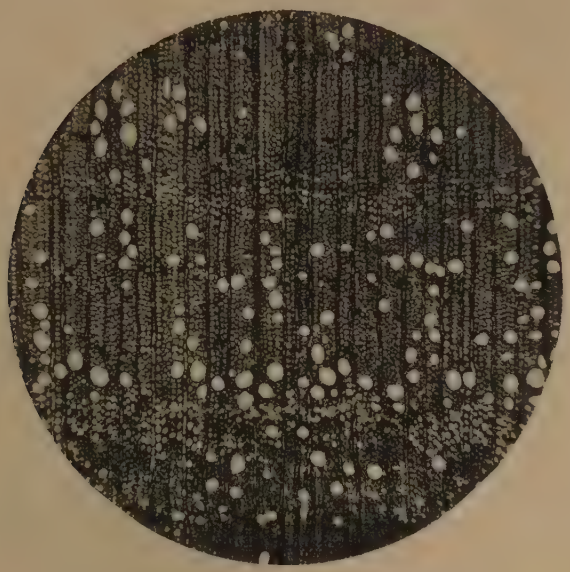
"MYRTLE."

TIMBER.

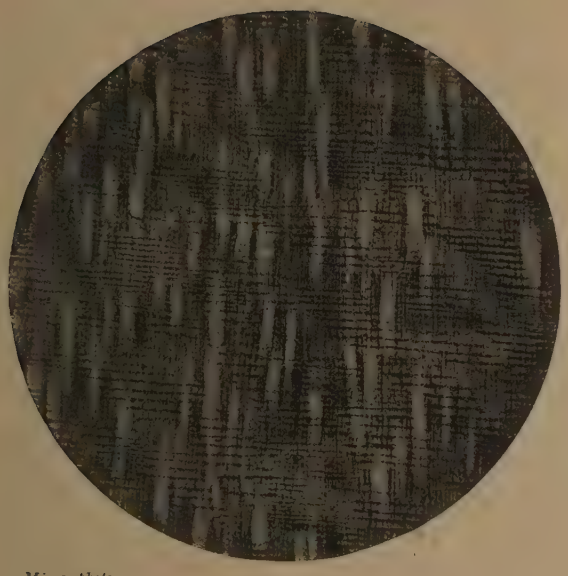
DESCRIPTION AND USES.

A hard, tough, close-grained timber, of a grey colour, with a wavy texture, which is plainly seen when the timber is split with the ray. The annual rings on the end section are characteristic of the genus, being in small undulations. It is rather difficult to work, although a good timber for certain parts of rolling stock, such as sole bars, coach and waggon framing and various other purposes requiring a hard timber. It has also been used with success as wood-working planes.

FIG. LXVIII.



CROSS SECTION, showing the small diameter of the fibres, and their regular radial arrangement; numerous rays, which compose nearly one-half of the wood structure; small pores; and wood parenchyma in two irregular bands, running from left to right of section.



Micro. photo.

RADIAL SECTION, showing predominance of rays and vessels.

[*T. C. Roughley.*

TANGENTIAL SECTION, showing fibres; vessels (centre), and wood parenchyma towards the left and right.

BACKHOUSIA SCIADOPHORA, F.v.M.

H. = Hard. W. = 58½ lb. per cubic foot.

ANATOMICAL FEATURES.

The characteristic feature of this wood is the large percentage of pores, the fibres are also numerous, having thick walls with many longitudinal perforations, the lumen rather limited. The wood parenchyma is either scattered amongst the fibres or in bands alternating with the fibres. The vessels have not a large diameter and like all the other elements, have no deposits and few examples of tyloses. The rays are specially numerous, about one or two cells in diameter and a few in height. In some cases tracheids were detected.

Systematic.

A tree, either glabrous or the young shoots minutely pubescent. Leaves broadly ovate, obtuse, 1 to 2½ inches long, on short petioles. Flowers small, numerous, in umbel-like cymes, or clusters on a common peduncle of ½ to ¾ inch in the upper axils, the slender pedicels often ½ inch long; calyx-tube glabrous, broadly campanulate, about 1 line long; outer tubes rounded or rather shorter, the inner ones rather longer than the tube. Petals broad slightly exceeding the calyx-lobes. Capsule filling the calyx-tube, flat-topped, apparently indehiscent, but readily separable into two cocci.

Geographical Range.

The North Coast district of New South Wales and Queensland.

Backhousia citriodora, F.v.M.

"LEMON-SCENTED MYRTLE."

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey (Q. Fl., Vol. II, p. 644) states that the wood is of a light pink colour, close grained, and hard.

Systematic.

A large tree, the young shoots under side of the leaves and inflorescence hoary-tomentose or at length glabrous. Leaves ovate or ovate-lanceolate, acuminate, coriaceous, glabrous above, 3 to 5 inches long, on pedicels of ¼ to ½ inch or more. Flowers small, numerous in umbel, like clusters on peduncles of 1 inch or more in the upper axils or at the ends of the branches, the slender pedicels above ½ inch long. Calyx-tube pubescent, broadly campanulate, about 1 line long, outer lobes broad and scarcely longer than the tube, inner ones longer and narrowed at the base. Petals shorter than the calyx, but not seen expanded.

Geographical Range.

North Coast of New South Wales, and the Coast district of Queensland.

Backhousia Bancrofti, Bail. et F.v.M.

"JOHNSTON RIVER HARDWOOD."

TIMBER.

Description and Uses.

F. M. Bailey (Q. Fl., Vol. II, p. 644) speaks of this timber as of a light grey colour, hard, close grained, something like Teak; a useful building timber, rather darker towards the centre in large trees, splits freely and straight.

Systematic.

A tall tree with a persistent, thin, somewhat scaly bark; the branchlets angular. Leaves penninerved, opposite, ovate-lanceolate, or those nearest to the inflorescence smaller or ovate-oblong, 2 to 4 inches long, 1½ to nearly 2 inches broad, very obtuse or shortly acuminate, tapering at the base to a petiole of about 3 lines; midrib and primary veins prominent, the latter looping far within the margin. Inflorescence terminal or in the upper axils, in trichotomous panicles, the common peduncle slender, about 2 inches long, bearing three to five pedicellate flowers at the end of the branches; pedicels slender, about 4 lines long. Calyx-tube broadly turbinate, strongly ribbed and slightly pubescent, scarcely 2 lines long; lobes five, unequal, broad and rounded, much imbricated, with more or less of a scarious margin, marked with prominent veins, persistent and enlarging somewhat after flowering. Petals five, orbicular, much crumpled and very deciduous, slightly larger than the calyx-lobes. Fruit a dry capsule, free except its broad base, oval, nearly ½ inch long, two or three celled, three seeds in each cell.

Geographical Range.

Johnstone River, Queensland.

Rhodomyrtus psidioides, Benth.

TIMBER.

Description and Uses.

According to F. M. Bailey (Q. Fl., Vol. II, p. 646) the wood is light coloured, close grained, and tough.

Systematic.

A tree attaining sometimes a great size, the young shoots more or less hoary-pubescent, the older foliage glabrous. Leaves petiolate, from oval-elliptical to ovate-lanceolate or oblong, shortly or obtusely acuminate, mostly 3 to 4 inches long, shining above, penniveined and prominently reticulate on both sides, the margins usually recurved. Peduncles axillary, rarely one-flowered, mostly with one, two, or three pairs of pedicels besides the terminal one, the lowest often again three-flowered, the pedicels all articulate below the calyx. Calyx-tube hoary-tomentose, thick, fully 2 lines long, lobes five or rarely four, shorter than the tube, ovate, the inner ones rather larger and thinner than the outer. Petals about 3 lines long. Berry ovoid-globular. Ovules and seeds superposed in six rows.

Geographical Range.

The North Coast of New South Wales and Brisbane River district of Queensland.

*Rhodamnia argentea, Benth.

"SILVER MYRTLE"

TIMBER.

DESCRIPTION AND USES.

A light grey coloured timber, and medium in weight for a hardwood. It has a pretty little silver grain, which makes it suitable for cabinet work, panelling, &c. It could also be used for carriage, waggon and wheelwrights' work, boot-lasts, gun stocks, and golf clubs. (C. W. Chapman.) A timber that could be tried for wood-working planes.

H. = Hard. W. = 51 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timbers of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	9,150	9,070	8,140
Modulus of rupture in lb. per square inch ...	17,941	17,960	15,960
,, elasticity ,, ,, ...	2,119,100	1,979,600	1,944,000
Rate of load in lb. per minute	1,016	1,133	1,162

Systematic.

A tall tree, the young shoots, under side of the leaves, and inflorescence more or less silvery-white with a close minute tomentum. Leaves oval or elliptical, obtuse, narrowed at the base, triplinerved with transverse veins and scarcely reticulate, 2 to 3 inches long, smooth and shining above. Peduncles axillary, solitary or two or three together, 2 to 4 lines long, each bearing either three or a trichotomous cyme of five to nine flowers on very short pedicels. Calyx tomentose; tube about 1 line diameter, lobes about as long as the tube, but rather unequal. Petals slightly tomentose, fully twice as long as the calyx-lobes.

Geographical Range.

Queensland, Moreton Bay district; New South Wales, Clarence River district.

*Eugenia Smithii, Poir.

"LILLY PILLY."

TIMBER.

DESCRIPTION AND USES.

A pinkish grey coloured timber, close grained, tough, and sometimes has a wavy, interlocked texture, somewhat similar to Tea-tree, Melaleuca species. It is fairly easy to work, and should be suitable for cabinet work, panelling, coach-work, golf clubs (C. W. Chapman) and veneers.

H. = Moderate. W. = 45 lb. per cubic foot.

Systematic.

A tree, somewhat small and slender, but in some places attaining a considerable height, quite glabrous. Leaves petiolate, from ovate to ovate-oblong or ovate-lanceolate, obtuse or more or less acuminate, narrowed at the base, mostly 2 to 3 inches long, smooth and finely penniveined. Flowers small and numerous, in a terminal trichotomous panicle, sometimes corymbose and shorter than the leaves, sometimes longer and more pyramidal. Bracts minute and deciduous. Calyx-tube turbinate, about 1 line long, the free part very much broader; lobes either very short, broad, and scarcely prominent, or one or two rather larger, almost petal-like and deciduous. Real petals four, united in a small flat, very deciduous calyptra. Fruit white or purple, globular, $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter, crowned by the circular prominent calyx-rim; endocarp thick and hard. Cotyledons closely combined.

Geographical Range.

The Coastal districts of Queensland, New South Wales, and parts of Victoria.

Eugenia Wilsoni, F.v.M.

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey states (Q. Fl., Vol. II, p. 662) that the wood of this tree is of a uniform dark-brown colour, close grained, hard, and tough; useful for building purposes, mallets, &c.

Geographical Range.

Rockingham Bay, Dallachy, Queensland.

Eugenia Coolminiana, C. Moore.

"COOLAMON." Plate 107.

TIMBER.

Description and Uses.

One of the very best brush timbers, being fairly hard, close, straight, or wavy grained, of a reddish brown colour. It is of a dry nature, but planes well; cut on the quarter the rays give a small neat figure, producing a facies not unlike that of *Exocarpus cupressiformis*, Native Cherry. It is eminently suited for heavy bridge, carriage, waggon and constructional works and other similar economics requiring strength. It is not, perhaps, too heavy for cabinet work, although the colour and radial cut would commend it for this purpose.

H. = Moderate. W. = 46 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb	5,470	6,080	5,530
Modulus of rupture in lb. per square inch ...	11,201	12,579	11,440
,, elasticity ,, ,, ...	2,107,000	1,961,500	1,510,100
Rate of load in lb. per minute	911	868	790

Systematic.

A typical average brush tree. Leaves generally larger and broader than in *E. myrtifolia*, ovate, opposite, acuminate, about 2 inches long, and from ½ to slightly over 1 inch broad, venation fine, paler on the underside, drying slate colour on the upper surface. Inflorescence axillary in trichotomous panicles or cymes, peduncles very slender, flowers small; calyx lobes persistent, stamens ¼ inch long. Fruit bluish, about ¼ inch in diameter.

Geographical Range.

Brush forests, Richmond and Tweed Rivers, New South Wales.

PLATE 107.

BRUSH CHERRY.
(*Eugenia Coolminiana.*)

PLATE 108.

BLACK APPLE.
(*Sideroxylon australis*, R.Br.)

NATURAL ORDER.

Rubiaceæ.

A VERY large Natural Order found in almost every part of the earth's surface, the chief economics, however, lie on the side of Pharmacy rather than timber, but several of the Australian species yield a hardwood.

Psychotria nematopoda, F.v.M.

"YELLOW HICKORY."

TIMBER.

DESCRIPTION AND USES.

A splendid brush timber, with colour and texture not unlike some of the Sapindaceæ or Rutaceæ.

It is close grained, uniformly pale yellow throughout, and has little sapwood, planes well with a compact surface, much resembling English "Box." It would make a splendid substitute for American Sycamore, and also is very suitable for such purposes as mangle rollers, &c. A desirable timber for cabinet work.

H. = Hard. W. = 50 lb. per cubic foot.

Systematic.

A brush tree, silky-tomentose. Leaves ovate-lanceolate, 1½ to 2½ inches long, pale on the underside, shortly petiolate. Stipules are lanceolate, 4 lines long, biacuminate, nerves and veins conspicuous. Peduncles axillary, 1 to 2 inches long. Bracts subulate, 1½ to 2 lines long. Calyx-teeth four, deltoid. Corolla bearded inside at the base, four lobed; lobes ovate. Anthers roundish, inserted at base of corolla; filaments very short. Style 1 line long, shortly bifid. Drupe globose-ovate, red, about 3 lines long; pyrenes two, smooth.

Geographical Range.

Mackay River district of Queensland.

Canthium coprosmoides, F.v.M.

TIMBER.

DESCRIPTION AND USES.

A hard, close-grained, fairly heavy timber, with brownish streaks or bands running longitudinally through it. The rays are fairly small, producing a neat pretty feature. It could be used in some forms of light carriage trade, also panelling and cabinet work.

H. = Hard. W. = 48 lb. per cubic foot.

Systematic.

An average forest tree, quite glabrous. Leaves obovate, ovate or broadly elliptical, obtuse, shortly contracted at the base, in some specimens all under 2 inches, in others 3 to 4 inches long, coriaceous but scarcely shining, the veins distant but not prominent. Flowers four-merous or five-merous, very shortly pedicellate, in sessile axillary clusters of three to six. Corolla tube slender, fully 4 lines long, bearded inside at the orifice, the lobes about half as long as the tube. Fruit sometimes ½ inch broad, on a pedicel of 2 to 4 lines.

Geographical Range.

The Coastal districts north from Sydney, New South Wales, extending to Northern Coastal areas of Queensland.

Canthium lucidum, Hook.f. and Arn.

TIMBER.

DESCRIPTION AND USES.

It is a very close-grained, hard, tough and strong timber, with a pale yellowish colour streaked with narrow dark bands. The medullary veins are very fine, so that little figure is produced on the quarter.

It could be used for machine bearings, or where strength is required in any industrial purpose.

H. = Hard. W. = 60 lb. per cubic foot.

Systematic.

A medium tree, perfectly glabrous. Leaves ovate, obovate or elliptical oblong, obtuse or scarcely acuminate, narrowed into a short petiole, scarcely exceeding 2 inches in some specimens, 4 to 6 inches long in others, coriaceous, very smooth and shining, with distant very oblique veins scarcely prominent. Flowers in axillary shortly pedunculate cymes, often large and many flowered, but shorter than the leaves. Corolla glabrous outside, slightly hairy inside, the tube about 1 line; lobes about 2 lines long. Fruit, when both carpels ripen, somewhat compressed and didymous, 3 to 4 lines broad, but often one seeded and nearly globular.

Geographical Range.

The Coastal districts of Queensland, extending south to the Clarence River in New South Wales.

Ixora Beckleri, Benth.

"BIRDSEYE."

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey (Q. Fl., Vol. III, p. 765), describes this timber as darkish, close grained and tough.

A hard, firm, close, straight-grained timber of a dark brown colour, streaked with yellow. On end section the annual rings are fine and close, medullary rays numerous, and almost invisible, and no apparent sapwood. Not being of large dimensions would be suitable for chisel handles, turnery, and other such purposes in the trade.

H. = Hard. W. = 55 lb. per cubic foot.

Systematic.

A tall shrub or small tree with a roughish bark, quite glabrous. Leaves ovate or elliptical, shortly acuminate, narrowed at the base, 3 to 4 inches long, smooth and shining. Flowers in corymbs rather dense, sessile and much shorter than the leaves. Calyx-limb short, irregularly toothed. Corolla-tube about 1½ inch long; lobes four, about as long as the tube; acute. Style-lobes short linear. Fruit 3 to 4 lines diameter. Seeds oval.

Geographical Range.

North Coast District of New South Wales and the scrub lands of Southern Queensland.

Ixora Timorensis, Benth.

"GOOMBRAGNE."

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey (Q. Fl., Vol. III, p. 765) describes this timber as of a light colour, close grained, hard and tough.

Geographical Range.

The Coastal areas of Northern Districts of Queensland and the neighbouring Islands.

Randia densiflora. Benth.

TIMBER.

DESCRIPTION AND USES.

A very pale yellow coloured, hard, very close, wavy grained timber, and much resembling English Box in colour and texture, and so could be utilised as a substitute for that timber.

H. = Hard. W. = 54 lb. per cubic foot.

Geographical Range.

The North Coast district of New South Wales and Coast district of Queensland.

Randia Fitzalani. F.v.M

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey (Q. Fl., Vol. III, p. 754) describes this timber as straw-coloured, close in the grain, hard and tough.

Geographical Range.

Tropical scrubs of Queensland.

NATURAL ORDER.

Epacrideæ.

A RATHER restricted Natural Order, being more particularly confined to Australia, East Indies, New Zealand, and a few South Sea Islands. The species are not generally famous for their timber, but a few found in Australia yield a good hardwood.

Monotoca elliptica, R.Br.

"BEECH" OR "PIGEON BERRY."

TIMBER.

DESCRIPTION AND USES.

A close-grained, light-brown, prettily marked, firm timber the rays producing a very neat figure, but a stronger and harder wood than its congener. It is very suitable for chisel handles, carpenters' mallets and other tradesmen's tools, having the characteristic of English Beech (*Fagus*).

H. = Hard. W. = 48 lb. per cubic foot.

Systematic.

A small tree of 30 to 40 feet. Leaves from broadly elliptical-oblong to almost oblong-linear, mucronate, slightly convex, pale or whitish and finely veined underneath, under ½ inch long on some specimens, from ½ to 1 inch in others. Flowers pedicellate, few or many together, forming short racemes, either terminal or also axillary, and sometimes exceeding the leaves or growing out into leafy branches, with a few solitary axillary flowers. Subtending bracts membranous, very deciduous, bracteoles not half so long as the calyx, and close under it. Sepals half as long as the corolla, broad and very obtuse. Corolla from scarcely 1 line to 1½ line long, campanulate, the lobes recurved, shorter than the tube.

Geographical Range.

The East Coast of Australia and Tasmania.

Trochocarpa laurina, R.Br.

"BRUSH CHERRY."

TIMBER.

DESCRIPTION AND USES.

A close-grained, prettily marked, tough, leathery timber, a shade deeper in colour than *Monotoca elliptica*, and perhaps not so hard, the rays producing a very nice figure. Suitable for tool handles, such as chisels, &c., and for mallets; should also make good planes. A similar timber to English Beech, but not quite so hard.

H. = Moderate. W. = 43 lb. per cubic foot.

Systematic.

A tree from 30 to 60 feet, quite glabrous. Leaves usually clustered at the ends of each year's shoots, so as to appear almost verticillate, petiolate, broadly oval or elliptical, acuminate, shining, five to seven nerved on both sides, mostly 1½ to 2 inches long. Flowers small, white in terminal solitary or clustered interrupted spikes, ¾ to 1 inch long. Bracts small, bracteoles obtuse, not half so long as the calyx. Sepals 1 line long or rather more, obtuse, striate. Corolla tube about 1 line long; lobes shorter than the tube. Drupe depressed, globular, 3 to 4 lines diameter, the pyrenes less readily separable than in the other species.

Geographical Range.

The Coastal district of New South Wales, North and South, and the East Coast of Queensland.

NATURAL ORDER.

Myrsineæ.

A NATURAL Order restricted in distribution, being found mostly in the Islands of the Southern Hemisphere. The species are not of much economic importance.

Two Australian trees are here recorded as they both yield hardwoods, although of limited dimensions.

Myrsine variabilis, R.Br.

TIMBER.

DESCRIPTION AND USES.

A light coloured, straight-grained, moderately hard timber. The Medullary rays are very pronounced, giving a pretty dark figure when cut on the quarter. It is very suitable for beautiful small furniture and other small decorative cabinet work.

Systematic.

A glabrous tree, attaining 30 to 40 feet. Leaves mostly obovate-oblong, obtuse or rarely shortly acuminate, entire or irregularly bordered by acute teeth, coriaceous, 1½ to 2½ inches long, or in other specimens rarely twice as large and thinner, narrowed into a petiole varying from scarcely ¼ to above ½ inch. Pedicels usually about 2 lines long. Calyx verys mall, with broad short lobes. Corolla, when perfect, 1½ line long or rather more; divided nearly to the base into four or five acute narrow lobes, valvate in the butt or nearly so.

Geographical Range.

The Eastern Coast districts of Australia, from North Queensland to South Victoria.

Ardisia racemosa, R.T.B.

TIMBER.

DESCRIPTION AND USES.

Timber light coloured, close grained, moderately hard, but on account of its size could probably only be used for turning, tool handles, &c.

Systematic.

A handsome glabrous tree, about 20 to 50 feet high, and 6 to 9 inches in diameter with a smooth grey bark. Branchlets terete. Leaves measuring up to 5 inches long and 1 inch wide, ovate-elliptical, acuminate, thin, almost membranous, pale-coloured on the underside; lateral veins fine, oblique. Flowers in short axillary occasionally lateral racemes; pedicels filiform, about 4 lines long. Sepals five, valvate, about ½ line long, acuminate. Petals five, about 1½ line long, imbricated and contorted in the bud, acuminate, glabrous, spotted similarly to the sepals, edges opposite the petals. Fruit not seen.

Geographical Range.

North Coast district of New South Wales.

NATURAL ORDER.

Sapotaceæ.

THIS is mostly a tropical Natural Order, so that the species coming down into Australia are few, but they, nevertheless, have very fine hardwoods, and are worthy of forestry cultivation.

SPECIES ILLUSTRATED IN COLOUR :

Sideroxylon australe, Benth. et Hook.f. (Black Apple).

Chrysophyllum pruniferum, F.v.M.

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey states (Q. Fl., Vol. III, p. 953) the wood is of a light yellow colour, close grained, hard, and tough, might be suitable for bent work.

Systematic.

A small tree, the branches and underside of the leaves tomentose-villous, with rust-coloured stellate hairs. Leaves shortly petiolate, ovate-elliptical or obovate-oblong, shortly and abruptly acuminate, penniveined, reticulate with transverse veinlets, glabrous above, mostly 3 to 4 inches long but sometimes larger. Flowers closely sessile in axillary clusters. Calyx hirsute with rusty hairs, lobes five, oblong about 1 line long, the inner ones with glabrous membranous margins. Corolla-tube shorter than the calyx, lobes five, longer than the tube, glabrous, reflexed, much imbricate in the bud. Stamens five. Style as long as the corolla. Fruit about 1 inch in diameter (the size of an Orleans Plum) not seen in a good state, the exocarp apparently thin and succulent, the endocarp crustaceous, and elegantly veined. Seeds one or two, large, albumen none (or thin); cotyledons large, thick and fleshy; radicle not prominent.

Geographical Range.

Queensland, the district of Rockingham Bay, New South Wales, North Coast.

Sideroxylon Pohlmaniana, F.v.M.

"BLACK APPLE."

TIMBER.

DESCRIPTION AND USES.

A very fine close-grained timber of the palest yellow colour, with all the qualities and texture of a *Buxus*, "English Box," but has the advantage of growing to a much larger tree, thus giving good sized

planks. It could be used for all the purposes enumerated under *S. australe*. The figure is not so pronounced as in *S. australe*, and the timber is of a much closer texture.

H. = Hard. W. = 58 lb. per cubic foot.

Wood Carving.

This is an excellent timber for carving in cases where an exceptionally fine finish or sharpness is required. The wood is exactly the same to work as English or Turkish "Boxwood," and would answer for all purposes where they are employed—*e.g.*, moulds for compo. or plastic ornaments; printer's blocks (which are cut on end grain). The grain is of very even texture; compact but not the least fibrous, and can be cut to almost any direction in finishing. Whilst such a timber can be procured there is no necessity to import "Boxwood."

Systematic.

An average brush tree, the branchlets thick, clothed, as well as the petioles, with soft appressed hairs. Leaves crowded at the ends of the branches, narrowly obovate-oblong, obtuse, contracted into a rather long petiole, rather thin, green on both sides, the principal veins more or less silky-hairy otherwise glabrous, 3 to 4 inches long. Flowers in clusters on the old wood below the leaves, almost sessile or the pedicels shorter than the calyx. Calyx-segments five, very much imbricate, orbicular, obtuse, 1½ line diameter, silky-hairy outside. Corolla about as long as the calyx, the lobes broad very obtuse, scales of the throat small and entire. Stamens inserted in the broad tube, the anthers imperfect in the flowers examined. Ovary surrounded by a dense ring of long hairs, tapering into a short, thick, glabrous style, five-celled; ovules laterally attached. Fruit globular, above 1 inch diameter, the flesh hard. Seeds five in the fruit opened, about ¼ inch long, ovate, somewhat compressed, hilum linear, lateral, albumen not very thick, cotyledons large, flat, thin; radicle very short.

Geographical Range.

The Coastal districts of Queensland, and New South Wales (north of Sydney).

Sideroxylon laurifolium, F.v.M.

TIMBER.

Description and Uses.

F. M. Bailey states (Q. Fl., Vol. III, p. 957) concerning this timber that it is of a light grey colour towards the outside, brown in the centre grain close.

Systematic.

Glabrous or the young shoots slightly pubescent. Leaves oval-oblong, or broadly oblong-elliptical, obtuse or scarcely acuminate, narrowed into a short petiole, thinly coriaceous, shining above, 3 to 5 inches long. Flowers clustered in the axils on pedicels of 4 to 6 lines. Calyx-segments five, broadly ovate, 2 lines long, usually subtended by a bract-like stem, but rather shorter and broader. Corolla only seen in bud, but apparently exceeding the calyx, the lobes broad and almost truncate; scales of the throat subulate. Anthers large. Ovary very villous, tapering into a thick glabrous style; ovules laterally attached near their base. Fruit black, ovoid, ¾ inch long, the pericarp not thick. Seeds one or more, the hilum very broad, and more than half as long as the seed; albumen copious, cotyledons very broad and flat.

Geographical Range.

East Coast of Queensland.

Sideroxylon australe. Benth. et Hook.f.

"BLACK APPLE." Plate 108.

TIMBER.

Description and Uses.

One of the finest hardwoods of Australia, having a pale yellow colour, with darker markings, very close and straight in the grain, which gives a characteristic figure when cut in the rings. It has the appearance of a coarser timber than that of its congener, *S. Pohlmaniana*, and is tough to work, but planes to a very smooth surface. Suitable for machine bearings, heavy carriage framing, marquetry, and specially as a carving timber.

H. = Very hard. W. = 66 lb. per cubic foot.

Wood Carving.

Like its congener, *S. Pohlmaniana*, this is an excellent timber for carving in cases where an exceptionally fine finish or sharpness is required. The wood is exactly the same to work as English or Turkish "Boxwood," and would answer for all purposes where they are employed—*e.g.*, moulds for compo. or plastic ornaments; printer's blocks (which are cut on end grain). The grain is of very even texture, compact, but not the least fibrous, and can be cut to almost any direction in finishing. Whilst such timber can be procured, there is no necessity to import "Boxwood."

Anatomical Features.

The chief feature of this wood is the remarkably thick-walled fibres, much resembling those of the Ironbarks, *E. paniculata* and *E. siderophloia*—the lumen consequently being of exceedingly limited diameter, and wall perforations very rare. The wood parenchyma is plentiful, disposed sometimes in bands of three or four cells in width, and sometimes scattered singly or in twos or threes amongst the other wood elements. The rays are numerous with two forms of cells horizontal and vertical, but contain no deposit. The vessels are rather small and tyloses are not often seen.

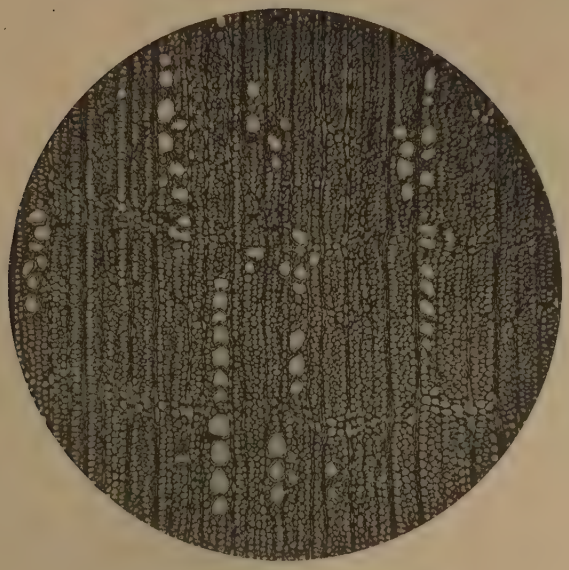
Systematic.

A tree attaining sometimes a great elevation, quite glabrous except a slight appressed pubescence on the very young shoots. Leaves shortly petiolate, from elliptical-oblong and shortly and obtusely acuminate to broadly obovate-oblong and very obtuse, mostly 3 to 4 inches long, but sometimes longer, usually much reticulate. Flowers in axillary clusters or almost solitary on pedicels of 2 to 3 lines. Calyx-segments five, broadly orbicular, about two lines diameter. Corolla scarcely exceeding the calyx, the lobes short and spreading. Fruit 1 inch in diameter. Seeds few, large, compressed, the hilum on the inner edge more than half as long as the seed, much broader than in *S. xerocarpa*, narrower than in *S. laurifolia*.

Geographical Range.

The Coastal districts of Queensland, from Rockhampton, in the north, to Kiama, New South Wales.

FIG. LXIX.



CROSS SECTION, showing smallness of pores and fibres, both arranged in radial rows; wood parenchyma in narrow rows across the plate.

Micro. photo.]

RADIAL SECTION, showing heterogeneous rays; celled wood parenchyma; and compact fibres especially to the left.

[*T. C. Roughley.*

TANGENTIAL SECTION, left half showing uniseriate rays amongst fibres and vessels; the right half mostly cutting through bands of wood parenchyma.

SIDEROXYLON AUSTRALE, BENTH. ET HOOK.f.

Sideroxylon argenteum, Spreng.

TIMBER.

Description and Uses.

This is another Australian timber which could be used as a suitable substitute for Box (*Buxus*), the wood possessing all the qualities of these species.

Systematic.

A small tree attaining about 20 feet, the branches and under side of the leaves minutely and often sparingly silky-pubescent. Leaves obovate or broadly elliptical, obtuse, narrowed into a short petiole, coriaceous, glabrous above, 3 to 5 inches long. Flowers in axillary clusters on pedicels about as long as the flowers, but attaining 3 lines when in fruit. Calyx-segments a little above 1 line diameter, orbicular, ciliate, membranous, the outer ones rather thicker and pubescent. Corolla small, spreading sometimes to nearly 3 lines diameter, the lobes broad and obtuse, scales of the throat ovate-acuminate or linear, sometimes very small, or one or two of them quite deficient. Anthers often shortly exceeding the corolla. Ovary densely hairy, at least round the circumference, tapering into a short, thick, glabrous style, five-celled, ovules laterally attached. Fruit obovoid or oblong, ¼ inch long or more, usually one seeded. Seed obovate, compressed; hilum linear, lateral; albumen not very thick; cotyledons broad, thin, and flat; radicle very short.

Geographical Range.

Endeavour River, Albany Island, Howick's Group.

NATURAL ORDER.

Ebenaceæ.

THIS is essentially a tropical Natural Order, and famous all over the world for its hardwood, especially those of Diospyros, the Ebony family, which genus is represented in Australia by a few species.

SPECIES ILLUSTRATED IN COLOUR:

Diospyros pentamera, F.v.M. (Grey Plum).

Diospyros pentamera, F.v.M.

"GREY PLUM." Plate 109.

TIMBER.

DESCRIPTION AND USES.

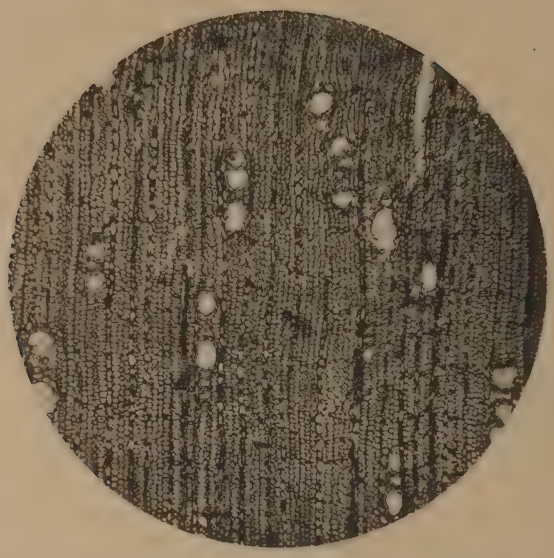
A dirty-grey coloured timber, with a fairly close, straight grain, and black markings which denote the natural order. Planes easily. Its uses are almost untried, but it has given great satisfaction as Golf shafts and heads (C. W. Chapman), possessing a good resilience. It should be suitable for coach and carriage building work, or darker coloured furniture.

H. = Moderate. W. = 41½ lb. per cubic foot.

ANATOMICAL FEATURES.

This timber possesses characteristic anatomical features which are perhaps best seen in the radial and tangential sections. In many of the cells of both the wood and ray parenchyma there is at the bottom of each cell a very small spherical body, somewhat similar to that found in *Orites excelsa*. Amorphous deposits also occur in some of the cells of the rays. The wood parenchyma shows a tendency to run in single concentric rings, with a few scattered amongst the fibres, which latter are thick walled with a very small lumen and very few wall perforations. The rays are of the heterogeneous type. The vessels are more often connate in twos or threes than singly, and have strong walls and septa. No tyloses were seen.

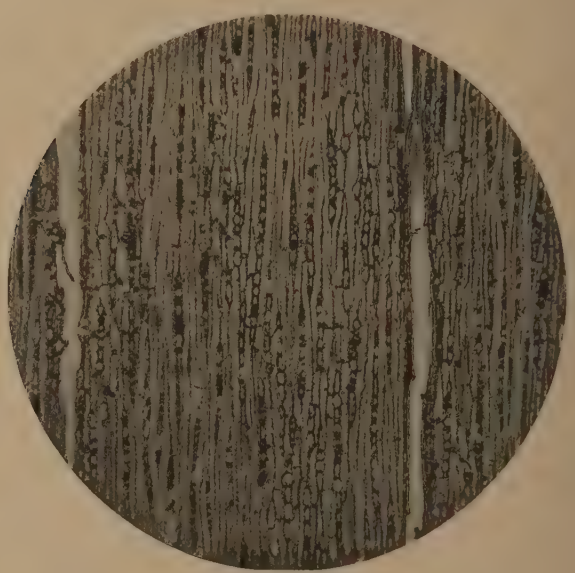
FIG LXX.



CROSS SECTION, showing uniform diameter of fibres with narrow lumen, arranged radially. The rays have both filled and empty cells; pores few with rather thick walls.

Micro. photo.]

RADIAL SECTION cut through the full height of a ray, in the cells of which are seen calcium oxylate crystals.



[*T. C. Roughley.*

TANGENTIAL SECTION, showing portions of two vessels; fibres; and ray and wood parenchyma.

DIOSPYROS PENTAMERA, F.v.M.

PLATE 109.

GREY PLUM.

(*Diospyros pentamera*, F.v.M.)

PLATE 110.

BUDDA OR SANDALWOOD.

(*Eremophila Mitchelli*, BENTH.)

Systematic.

A tree attaining a considerable height, glabrous on the young shoots, slightly silky. Leaves oblong-lanceolate, or elliptical, slightly acuminate but not acute, contracted into a very short petiole, coriaceous, shining and reticulate above, opaque and less veined underneath, 1½ to 2½ inches long. Male flowers in very shortly pedunculate clusters of three to five. Calyx 1 line long, five-lobed. Corolla twice as long as the calyx, five lobed, the tube short. Stamens fifteen to twenty. Female flowers not seen. Fruit solitary, sessile, the subtending calyx enlarged, appressed or the lobes slightly spreading. Berry globular, about ½ inch diameter.

Geographical Range.

North Coast districts of New South Wales and Southern Coastal district of Queensland.

Diospyros Cargillea, F.v.M.

"BLACK PLUM."

TIMBER.

DESCRIPTION AND USES.

The description given under *D. pentamera* applies almost practically to this species.

Systematic.

A fair-sized tree, glabrous on the young parts, very minutely mealy-pubescent. Leaves from oblong to oval-elliptical, obtuse, narrowed into a short petiole, coriaceous, penniveined and reticulate, but the veins less conspicuous on the under-side, 1½ to nearly 3 inches long, the tube as long as the calyx; lobes four, contorted in the bud. Stamens about twelve, slightly cohering to the base of the corolla. Female flowers solitary or two or three together, larger than the males; stamens usually fewer and imperfect. Ovary four-celled, with two ovules in each cell without any trace of dissepiment between them. Fruiting calyx enlarged to nearly ½ inch diameter. Berry globular.

Geographical Range.

The Coastal districts of Queensland and New South Wales.

Maba fasciculosa, F.v.M.

TIMBER.

DESCRIPTION AND USES.

A close, straight-grained, very pale pinkish coloured timber not unlike some *Nepheliums*, but the black flecks readily differentiate it from that genus and give the key of its Natural Order.

It is good for carriage work and for general purposes, but its full economics have not been investigated.

H. = Hard. W. = 51 lb. per cubic foot.

Systematic.

A tall tree, quite glabrous, oval-oblong or elliptical, obtuse or obtusely acuminate, shining above and scarcely opaque underneath, not much reticulate, 3 to 5 inches long. Female flowers often numerous, in axillary clusters or short cymes. Calyx about 2 lines long, the lobes deeper and more spreading at the time of flowering than in other species. Corolla-tube short, the lobes broad. Staminodia none in the female flowers. Fruit globular, about ½ inch diameter, the fruiting calyx enlarged, cup-shape, with short broad recurved lobes.

Geographical Range.

North Coast district of New South Wales; and Queensland, Rockhampton district.

The following species of this genus are separated systematically mostly by size of the leaf, venation, and fruits, and individual timbers.

M. reticulata.
M. germinata.
M. humilis.

MABA RETICULATA, R.Br.

F. M. Bailey states of this timber (Q. Fl., Vol. III, p. 964) that the wood is of a light colour, with black specks or streaks near the heart; very close in the grain, strong, elastic, useful in making carpenters' benches and hand screws.

MABA GERMINATA, R.Br.

The wood, according to F. M. Bailey (Q. Fl., Vol. III, p. 964), is light coloured near the outside, black in the centre, close in grain, hard and tough; the black is a good substitute for ebony.

MABA HUMILIS, R.Br.

According to F. M. Bailey (Q. Fl., Vol. III, p. 964) the outer part of this wood is coloured, the centre nearly black; hard and very tough; a useful cabinet wood.

NATURAL ORDER.

Styraceæ.

A NATURAL Order with sparsely distributed species in warm and tropical countries, and so the species are few in Australia. Symplocos hardwood is of good quality and representative of the family.

Symplocos spicata, Roxb.

TIMBER.

DESCRIPTION AND USES.

A hard, close, straight-grained timber of a very pale yellow colour. The quarter figure is very prominent, the rays being very distinct and high, with a figure somewhat like *Villaresia Moorei*. It is easy to work, and, with its close nature, would probably be a favourite for carving and engraving purposes, and general carriage body and cabinet work, panelling, &c. It somewhat resembles English Beech.

H. = Moderate. W. = 44 lb. per cubic foot.

Systematic.

A moderate-sized tree, quite glabrous. Leaves usually oval-elliptical or oblong-elliptical, but varying from obovate to lanceolate, obtuse or shortly acuminate, entire or irregularly toothed, contracted into a petiole, mostly about 4 inches long, but sometimes larger, smooth and often shining, but scarcely so much so as in *S. Thwaitesii*. Flowers small, sessile or nearly so, and often numerous in axillary spikes, sometimes simple, but more frequently branched into a panicle of 1 to 2 inches. Bracts and bracteoles small and very deciduous. Calyx-lobes exceedingly short, broad. Petals about 1½ line long, cohering in a ring with the stamens, which are sometimes obscurely five-adelphous. Fruit in the Australian form ovoid, contracted at the top.

Geographical Range.

East Coast of Queensland and North Coast of New South Wales.

Symplocos Thwaitesii, F.v.M.

TIMBER.

DESCRIPTION AND USES.

Almost identical in characters and uses to its congener *S. spicata*.

Systematic.

A tree attaining sometimes a considerable size, quite glabrous, closely resembling *S. spicata* in habit and characters, but the leaves are usually firmer and more shining, and the flowers considerably larger and more distinctly pedicellate, forming simple or branched racemes; the pedicels, however, rarely exceed 1 line. Calyx-lobes broad and obtuse, the innermost much larger than the outer ones. Petals nearly 3 lines long. Fruit when young oblong, contracted at the top, but not seen ripe.

Geographical Range.

The North Coast of New South Wales and the East Coast of Queensland.

NATURAL ORDER.

Oleaceæ.

THE most famous timber of this Order which occurs principally in temporate regions is that of *Fraxinus* (Ash), but this genus does not occur in Australia, where the family has only a few representatives. The Olive family has one species especially noted for its hardwood, *Olea paniculata.*

Olea paniculata, R.Br.

"CLOVE BERRY" OR "MARBLE WOOD."

TIMBER.

DESCRIPTION AND USES.

A hard, close-grained, tough and interlocked timber. The inner portion is yellow with brown streaks, giving it a marble figure, the outer portion being pale pinkish with a figure resembling some of the *Sapindaceæ*. Both the rays and annual rings are very fine and compact. It is rather difficult to work, but should be suitable for heavy rolling stock, coach framing and certain parts of ship-building, machine bearings and general constructional work. Closely resembles *Cadellia monostylis* (*see* Coloured Plate 9).

H. = Hard. W. = 59 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timbers of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	8,710	10,900	8,290
Modulus of rupture in lb. per square inch ...	17,420	21,161	16,254
,, elasticity ,, ,, ...	2,250,000	2,294,200	2,184,500
Rate of load in lb. per minute	1,088	1,211	1,274

Systematic.

A tree of moderate size, quite glabrous. Leaves on rather long petioles, ovate-lanceolate or elliptical, acuminate, 2 to 3 or rarely 4 inches long, penniveined underneath, but not conspicuously reticulate. Flowers small, all pedicellate in loose trichotomous panicles, terminal or more frequently in the upper axils, and sometimes exceeding the leaves. Calyx scarcely 1 line diameter. Style very short; stigma either broad, thick, and shortly two-lobed or clavate and unilateral. Fruit ovoid, resembling that of the common olive.

Geographical Range.

North Coast district of New South Wales, and the Coastal district of Queensland.

Notelaea ligustrina, Vent.

"SILK WOOD."

TIMBER.

DESCRIPTION AND USES.

A pale coloured almost white timber, somewhat resembling English Holly, or better perhaps American Sycamore, Maple or Birch.

It is hard, close grained and suitable for carriage work, domestic utensils of the harder kind.

H. = Hard. W. = 59 lb. per cubic foot.

Systematic.

A medium-sized tree, said to attain sometimes 30 feet, glabrous, but the young shoots often hoary or whitish. Leaves lanceolate, usually narrow, obtuse or rarely acute, contracted into a short petiole, rather thick, smooth, without thickened margins, quite veinless or with a few scarcely conspicuous and never prominent veins. Racemes short and sessile, but the pedicels often rather long. Calyx-lobes from one-third to one-half as long as the petals, which are rather smaller and less in duplicate than in *N. longifolia*. Fruit nearly globular, varying from white to purple, and every shade of pink or red (Gunn), nearly $\frac{1}{4}$ inch diameter when fully ripe.

Geographical Range.

Southern Coast district and Dividing Range of New South Wales, extending to Victoria and to Tasmania.

The following have timbers almost equal in texture and colour to *N. ligustrina*, and they could be utilised for similar economics enumerated under that Species.

N. ovata, R.Br.
N. longifolia, Vent.
N. microcarpa, R.Br.

NATURAL ORDER.

Apocyneæ.

THIS is principally a tropical Natural Order, and is not well represented in Australia in the way of hardwoods.

Ochrosia Moorei, F.v.M.

TIMBER.

DESCRIPTION AND USES.

A hard, close, straight-grained timber of a pale canary-yellow colour, and slightly greasy to work. The rays are very fine and numerous, the annual rings close and compact. The timber very much resembles the outer wood of Black Plum, *Cadellia monostylis* both in colour and character, and could almost be used for the same purposes as that timber, and it somewhat resembles in texture and physical properties the well-known Box (*Buxus*).

H. = Moderate. W. = 53 lb. per cubic foot.

Systematic.

A slender tree, quite glabrous. Leaves mostly opposite, narrow-oblong, or oblong lanceolate, acuminate tapering in a short petiole, the transverse veins not near so close and numerous as in *O. elliptica*, and the texture thinner, 3 to 6 inches long. Inflorescence in slender dichotomous cymes, usually three at the ends of the branchlets, bearing at their extremities a few sessile (except the one in the fork) flowers. Calyx-segments angular, thick and concave, about 1½ line long. Corolla-tube about 4 lines long, scarcely swollen and hairy round the anthers; lobes about 3 lines long. Fruit scarlet,, 2½ inches long and 1 inch broad, obtuse, and flattened; endocarp smoothly sculptured in pits or wavy lines.

Geographical Range.

Tweed River district of New South Wales.

NATURAL ORDER.

Loganiaceæ.

A NATURAL Order more particularly famous for the deleterious properties found in the different organs of its plants than for its timbers. A few species occurring in Australia can be ranked as hardwoods, but, though of no special commercial importance, yet are very interesting for their unique structure.

They are mostly tropical and sub-tropical trees and shrubs.

Strychnos arborea, A. W. Hill.

TIMBER.

DESCRIPTION AND USES.

A hard, close-grained, very pale yellow coloured timber, characterised by white streaks, the result of a deposit in the wood parenchyma or sacs. This deposit gives it quite a specific feature and produces a remarkable appearance in the longitudinal and cross sections. Until this substance has been chemically investigated it would not be well to recommend this for any special technical purpose, although at present it might be experimented with for cabinet work.

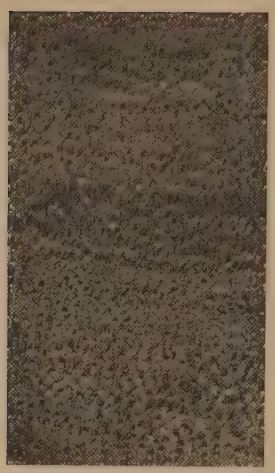
H. = Hard. W. = 62 lb. per cubic foot.

ANATOMICAL FEATURES.

The chief microscopic, and for the matter of that, macroscopical characteristic feature of this timber is the presence of unusually large parenchyma crystal sacs which permeate the wood element in the long axis of the wood, measuring apparently the whole length of a vessel.

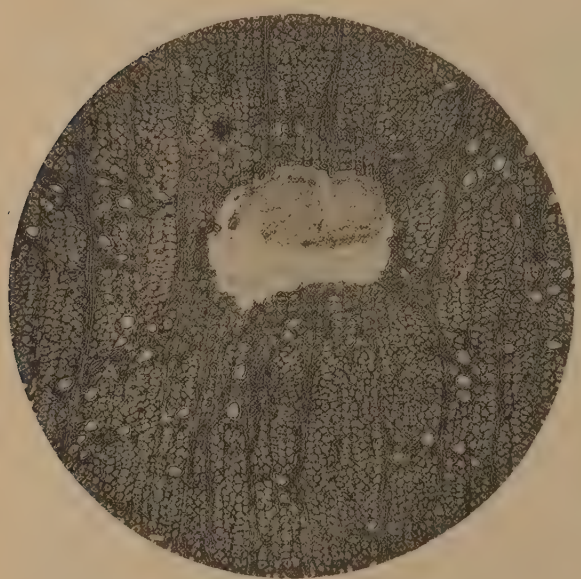
In a longitudinally planed surface they appear as so many chalk lines running through the wood, a feature not possessed by any other Australian timber examined, either hard or soft. Unfortunately, in section cutting most or nearly all the cell walls of these sacs are removed and a portion remaining in one transverse section showed them to be of exceedingly thin texture, enclosing in this view rhombus shaped crystals of Calcium oxalate.

FIG. LXXI.



CROSS SECTION, natural size, showing how it it permeated with parenchyma sacs (white).

LONGITUDINAL SECTION; the white lines are the parenchyma sacs, seen end-on in the cross section.



Micro. photo.]

CROSS SECTION through large crystal sac (showing crystals of calcium oxylate *in situ*) surrounded by rather thick wall wood parenchyma, with which are connected the rays, separating the wood fibres.

[*T. C. Roughley.*

TRANSVERSE SECTION, showing compact body of fibres and heterogeneous rays.

STRYCHNOS ARBOREA. A. W. HILL.

The fibres are of varying diameter, with an occasional secondary layer of cellulose which has a lumen dumb-bell shaped when cut in a cross section; they have little regularity of arrangement, and the perforations are fairly numerous. The wood parenchyma is a notable feature, being scattered irregularly amongst the fibres and vessels in several clusters, radial lines or tangential groups, and are almost invariably filled with an amorphous substance, as also are the ray cells.

The rays are fairly numerous, the inner rows of cells having the long axis radial and the outer cells vertical.

The vessels are fairly numerous, and mostly conjugate.

Systematic.

A small tree with weak but scarcely climbing branches (occasionally spinescent). Leaves broadly ovate, shortly acuminate, smooth and shining when old, three or five-nerved, contracted into a very short petiole, 1½ to 2 inches long. Flowers five-merous, in small thyrsoid or short panicles, axillary and terminal, rarely exceeding the leaves. Calyx minute. Corolla not 2 lines long, the tube very short; lobes rather longer than the tube, broad and thick, bearded inside at the base. Anthers nearly sessile in the throat. Berry globular, about ½ inch in diameter. Seeds usually solitary, orbicular, glabrous, not shining.

Geographical Range.

The North Coast district of Queensland and Islands adjacent.

Strychnos lucida, R.Br.

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey states of this timber (Q. Fl., Vol. III, p. 102) that the wood is of a dark-grey colour, very tough and elastic, useful as hoops for casks.

Systematic.

An erect divaricately branched shrub, often tall, glabrous except the minutely pubescent inflorescence. Leaves ovate, obtuse, obtusely acuminate, or almost acute, three or five-nerved, thinly coriaceous, shining above, more or less glabrous underneath, 1½ to 3 inches long, contracted into a very short petiole. Flowers five-merous, in corymbose trichotomous cymes, shortly pedunculate above the last pair of leaves. Calyx-lobes scarcely above ½ line long, ciliolate. Corolla-tube cylindrical about 3 lines long, very slightly hairy inside; lobes narrow, about 1½ line long. Anthers almost sessile in the throat. Ovary glabrous, with numerous ovules in each cell; style either much shorter than the corolla-tube with a peltate stigma, or nearly as long as the whole corolla with a smaller stigma. Berry globular, orange-brown, 1 to 1½ inch diameter. Seeds few, flat, orbicular, about 5 lines diameter; testa membranous densely silky-hairy; albumen cartilaginous, splitting into two halves; cotyledons broadly ovate.

Geographical Range.

The Coast district and Islands of Northern Queensland.

NATURAL ORDER.

Myoporineæ.

THIS is a Natural Order with a limited world distribution, the genus *Eremophila*, from which at least one specimen of cabinet timber is obtained, being endemic to Australia. "Budda," or New South Wales Sandalwood, *Eremophila Mitchelli*, has an extensive range in the interior. The Sandalwood of Western Australia is *Fusanus spicatus*, N.O. *Santalaceæ*. The Sandalwood of the East is *Santalum album*, Linn.

SPECIES ILLUSTRATED IN COLOUR:

Eremophila Mitchelli, Benth. (Budda).

Eremophila Mitchelli, Benth.

"BUDDA" OR "N.S.W. SANDALWOOD." Plate 110.

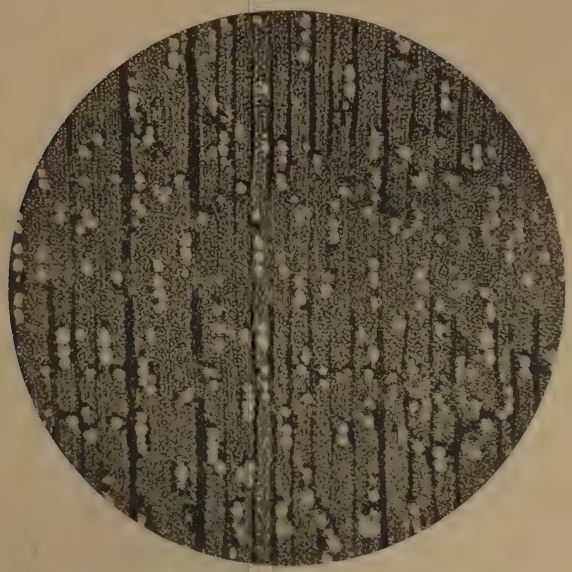
TIMBER.

DESCRIPTION AND USES.

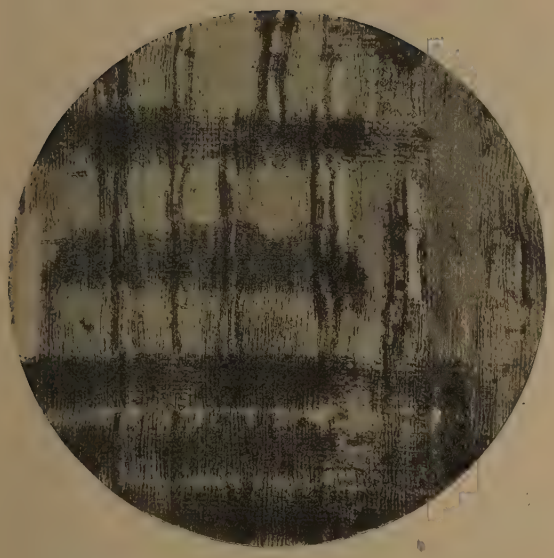
In some parts of New South Wales and Queensland this tree is fairly plentiful. It is a comparatively hard, close-grained, sepia-coloured timber, possessing a pleasing aromatic principal, which has given it the common name of Sandalwood. The other Australian Sandalwood occurs in Western Australia, and is *Fusanus spicatus*, R.Br. The timber is pale chocolate or brown with light streaks running through it. It is hard, close grained, but with small medullary rays, nevertheless, it would look well in cabinet work and might be used for veneers, boxes, brushes, and fancy or ornamented goods generally; rarely found on the Sydney market, its habitat being in the interior of the country. There is no reason why it could not be put on the market as New South Wales Sandalwood, for it could be used for similar purposes as an Eastern variety.

H. = Very hard. W. = 68 lb. per cubic foot.

FIG. LXXII.

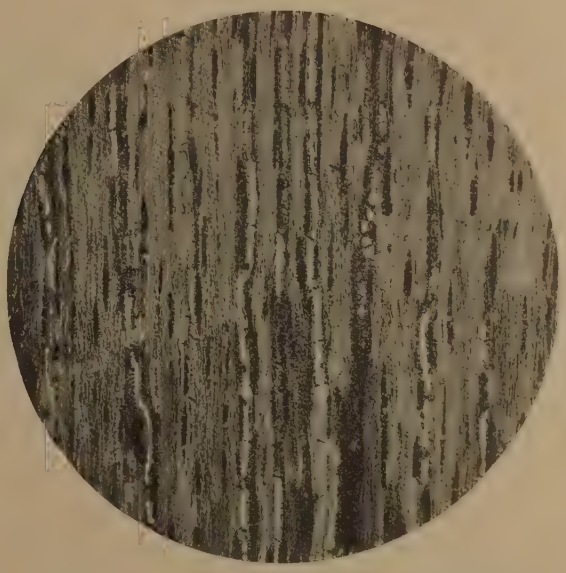


Cross Section: showing fineness of fibres, prominent rays with dark-coloured deposit in cells, small yet numerous thick-walled pores.



Micro. photo.]

RADIAL SECTION, showing rays filled with dark-coloured deposit, and compact masses of fibres.



[*T. C. Roughley*

TANGENTIAL SECTION showing vessels in centre with septa, rays and fibres.

EREMOPHILA MITCHELLI, BENTH.

Systematic.

A medium-sized tree, 50 to 60 feet, with a rough bark, and a strong aromatic timber. Leaves linear, lanceolate, 1 to 3 inches long, obtuse or with a recurved point. Flowers solitary in the axils, on pedicels of about ½ inch long. Calyx segments oblong or cuneate-oblong, obtuse, membranous veined, glabrous or pubescent, nearly ⅓ inch long, Corolla white or purplish, almost ½ inch long. Stamens shorter than the corolla. Fruit ovoid, almost acuminate, half as long as the calyx, the exocarp thin and membraneous, the endocarp separating into four nuts, each with one or with two spuer-imposed seeds.

Geographical Range.

Found in the interior of Queensland, New South Wales, and South Australia.

Eremophila longifolia. F.v.M.

"EMU BUSH,"

TIMBER.

DESCRIPTION AND USES.

A hard, close, wavy interlocked grained timber, pale coloured with dark centre, otherwise similar in colour to *Eremophila Mitchelli*, Budda. Rather difficult to work with hand planes. Timber is sound right out to the bark. Annual rings fine and numerous, medullary rays not visible macroscopically. The wavy figure somewhat resembles Satinwood. Should be suitable for ornamental caskets, glove boxes, marquetry, and decorative panelling.

H. = Hard. W. = 57 lb. per cubic foot.

Systematic.

A tall erect shrub, the young shoots minutely hoary tomentose, the older foliage nearly glabrous, often drying black. Leaves scattered, linear or almost linear-lanceolate, obtuse or tapering into a recurved point, rather thick but flat, 2 to 4 or even 5 inches long, contracted into a short petiole. Flowers solitary or two together. Calyx-segments triangular or lanceolate, acute or acuminate, rarely 2 lines long, united at the base and scarcely overlapping, usually woolly-ciliate on the margins. Corolla velvety pubescent outside, ¾ to 1 inch long, the tube gibbous at the base, contracted over the ovary, the remainder much dilated and slightly incurved, the lobes all ovate and obtuse, the two uppermost rather smaller and the lowest often but not always more deeply separated than the others. Fruit ovoid or globular, very succulent, with a thick hard putamen, completely four-celled and not separating into pyrenes.

Geographical Range.

Throughout Australia.

NATURAL ORDER.

Verbenaceæ.

It is from a genus of this Order that the famous Indian Teak is obtained, and its best representative occurs in the tropics, although some good specimens are found in the temperate zones. The finest trees in Australia are those going under the generic name of *Gmelina*, or commonly, in New South Wales at least, "Beech," but most fall in the class of softwoods. There are several good hard woods in the order, but they have not yet come to the front. The principal Australian hardwood representatives are:—*Avicennia officinalis*, Linn., and *Vitex lignum-vitæ*, A. Cunn.

Avicennia officinalis, Linn.

"GREY MANGROVE."

TIMBER.

Description and Uses.

The timber of this Australian tree may be described as a pale coloured, very hard, heavy, cross laminated timber, inclined to slightly darken on exposure. It has several characteristics that easily differentiate it from any other timber, and these are here described in sequence (infra). It is used in New South Wales for boat knees, crooks, breast hooks, and generally in boat building when strength is required, and in former days dead-eyes, barrels for steering wheels, winch ends, on account of its strength.

Viewing a transverse section of a mature tree, the annual rings as obtains in ordinary dicotyledonous stems might be said to be well defined, but with this difference, that the rings are not continuous, the breaking being caused by an intrusion of another ring, and thus the complete circle is broken.

By forcing the rings apart tangentially a good view is obtained of the disposition of the fibres. Each ring of fibres is seen to

be at quite a different angle to that in juxta-position to it. Sometimes they run perpendicularly, but more often at varying angles to each opposing ring.

The structure of the timber much resembles 3, 4, or 5-ply veneer which can now be shown to be only a copy of nature, for in the manufactured article the fibres of each sheet of wood are at right angles to each other instead of at oblique angles, as obtains in this instance, which is the main reason for the difficulty in splitting, in both cases.

There is another remarkable feature about this wood, and that is its resistance to splitting radially, for it is impossible to so split a log, say, 3 feet or more in length. Tangentially it is much more fissile, and in this direction it is more easily split than any other timber known to me. The aborigines were cognisant of this character, as shown by their preference for it for shield making.

H. = Hard. W. $\doteq$ 53 lb. per cubic foot.

ANALYSIS OF THE ASH.

The ash was used by early settlers at Port Macquarie in the manufacture of soap, in preference to that of all the other trees in the district. An analysis made by Mr. H. G. Smith, F.C.S., Assistant Curator, gave the following results :—

The percentage of Soda as Carbonate being so large, it is readily seen how useful such material could be made for such a purpose.

The large amount of alkalis renders the ash easily fusible, and some difficulty was experienced in preparing it in a fit state for analysis; it was necessary to dissolve out the alkalis before all the carbon could be removed.

The percentage of ash calculated on the anhydrous wood was 2·43 per cent. There were no sulphates remaining in the insoluble portion, nor were phosphates detected in the soluble. The amount of silica was very small, and only a trace of iron was present. Manganese was detected, but only in minute traces. The silver precipitates were decomposed by Zinc, and in the filtrate Bromine was detected, but not Iodine.

The composition of the ash was determined as follows :—

Potassium sulphate	... ...	2·26 per cent.
Potassium chloride	... ...	19·58 ,,
Sodium chloride	... ...	7·60 ,,
Sodium carbonate	... ...	41·61 ,,
Calcium phopshate	... ...	7·01 ,,
Calcium carbonate	... ...	9·94 ,,
Magnesium carbonate	... ...	11·73 ,,
Silica	... ...	0·13 ,,
Loss and undetermined	... ...	0·14 ,,
		100·00 ,,

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timbers of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load	6,610	6,620	7,070
Modulus of rupture in lb. per square inch ...	12,850	12,900	13,800
,, elasticity ,, ,, ...	1,680,000	1,690,000	1,725,000
Rate of load in lb. per minute	3,860	4,000	4,000

ANATOMICAL FEATURES.

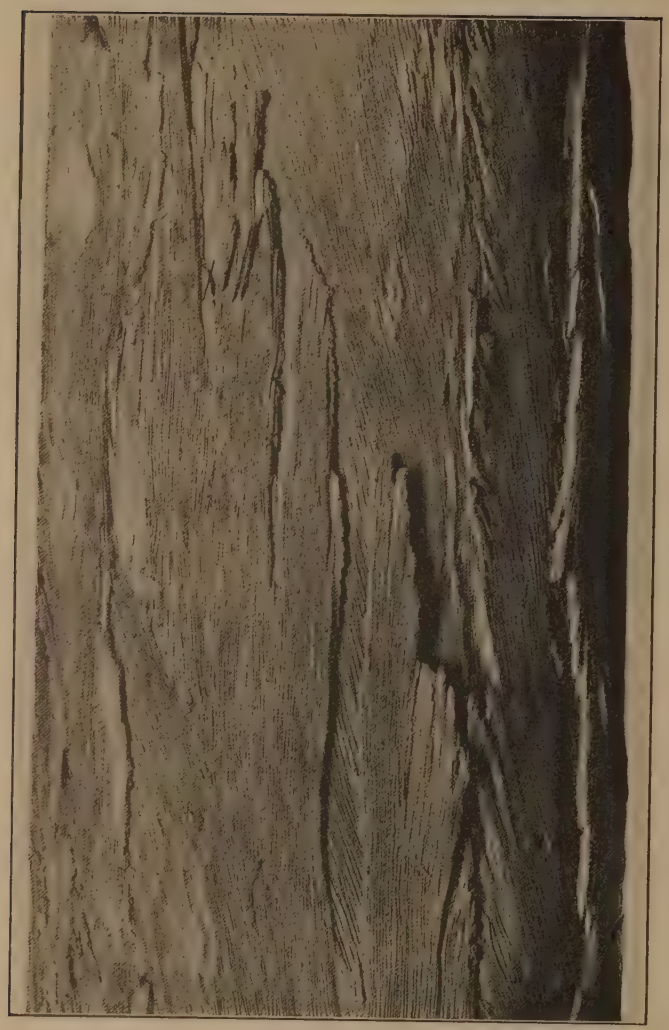
This is one of the most remarkable of timbers, the main wood elements all occur in it, but to these must be added isodiametric concentric vertical bands of sclerenchymatous cells. The fibres are thick walled with small lumen, compressed into polygonal shapes. The wood parenchyma runs in (1) concentric bands enclosing bands of stone cells, and (2) clustered around the vessels and also in radial bands. The ray parenchyma probably differs from that of every other in the botanical kingdom in that it is not *medullary*, but only extends between each band of the stone cells and is thus cut off entirely from the phloem and the centre of the tree. The pores are numerous, and mostly two or more conjugate. Amongst the wood elements are seen groups of (apparently) broken cells. Tracing these back from a two or three years' old twig, they are seen to be the phloem cells of the bundles and stain purple, with hæmatoxylon, as with other phloems. They are composed of thin walled bast parenchyma and bast stone cells, the latter showing the long axis in the longitudinal section, and with comparatively thin walls, both being filled with what is probably a tannin substance. Combined they make up the remarkable "dottings" on the outer edge of each concentric ring, which continue to appear almost regularly as the tree attains maturity, and macroscopically examining a piece of timber they appear as rows of pin pricks. I believe these perform all the functions of the ordinary bark of a dicotyledonous plant, as injury to the outer cortex has no effect on the life of the tree.

Owing to the twisting of the fibres a difficulty was experienced in obtaining radial and tangential sections cut in the plane of the wood elements as obtains in the other sections here illustrated.

Transverse Section.—In this section is seen a bifurcated band of thick-walled cells forming the barrier to the progress of the rays to continue beyond the limits of each ring. This wall of sclerenchymatous cells is bounded on either side by wood parenchyma, with thin walls, and between these are the wood fibres with small lumen.

Tangential Section.—In this view are clearly brought out the different angles or planes in which the fibres run, and the sclerenchymatous

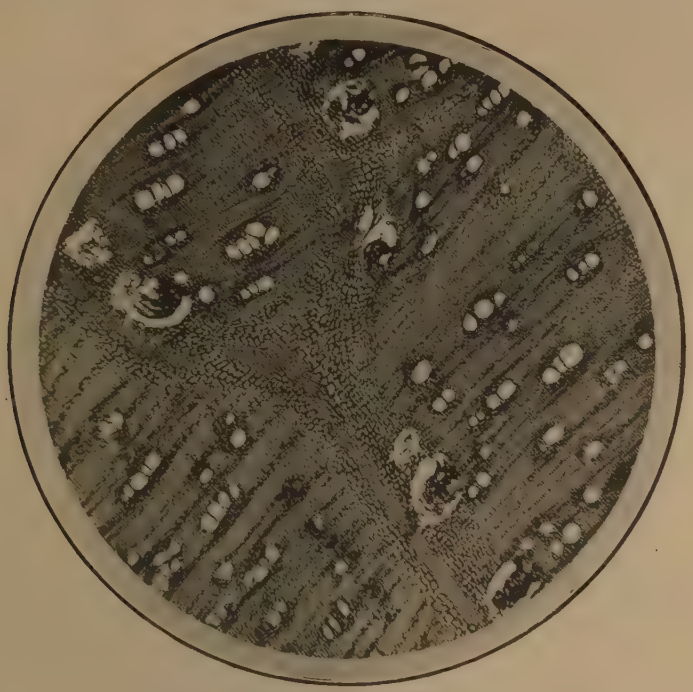
FIG. LXXIII.



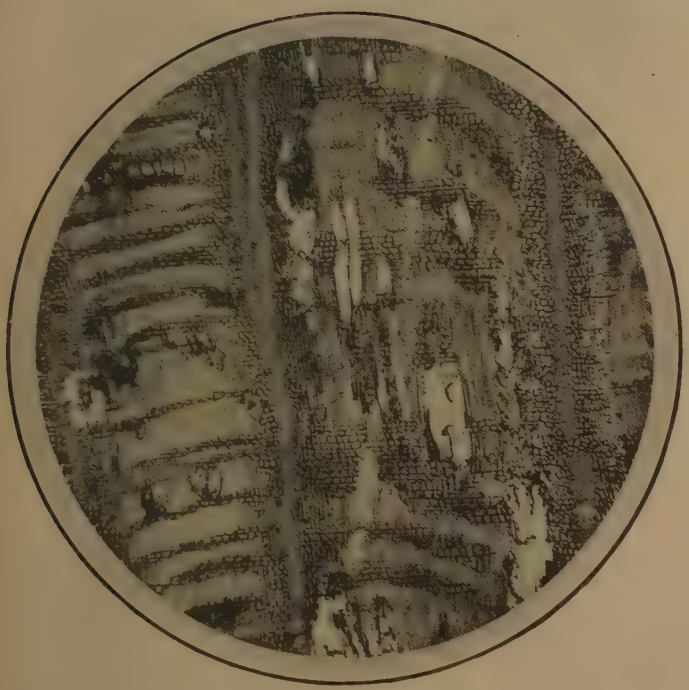
Specimen of wood split tangentially showing the natural ply arrangement of the fibres. Probably the only timber in the world possessing this feature. Natural size.

cells are seen to be exactly the same shape as in the transverse section, showing that they are short, isodiametric bodies and not elongated. It is due to this particular form that the timber splits so readily tangentially, there not being a length of fibre to give an interlocking strength, or in other words no cross structures such as would occur if the rays ran through and held together the annual rings. The phloem cells with the broken content are here seen longitudinally.

FIG. LXXIV.

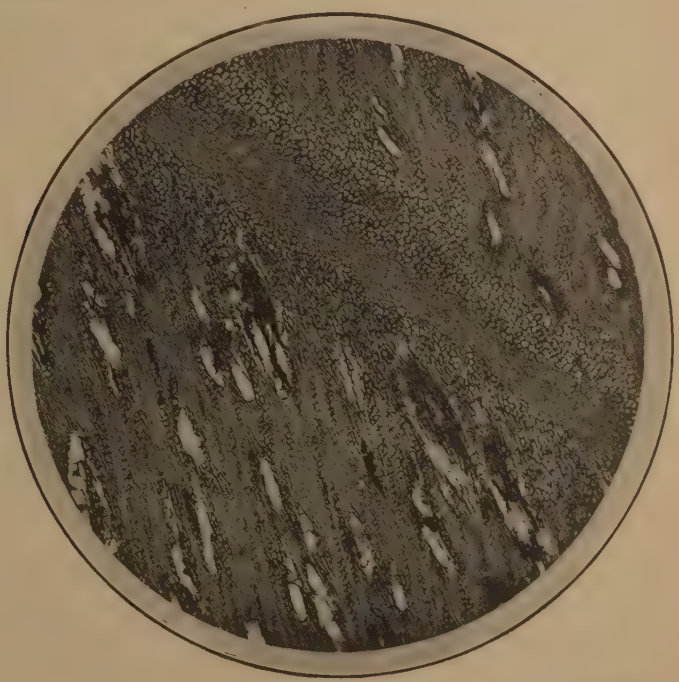


CROSS SECTION, showing bifurcated band of sclerenchyma cells stopping the rays from becoming medullary; wood parenchyma cells bounding the sclerenchyma or stone cells X 35.



Micro. photo.]

RADIAL SECTION, showing rays, column of sclerenchyma cells (left of centre), vessels, rays, and phloem cells. X 35.



[*T. C. Roughley.*

TANGENTIAL SECTION, showing phloem cells (dark, black, irregular patches), fibres, and parenchyma close to oblique sclerenchyma band. X 35.

AVICENNIA OFFICINALIS, LINN.

Radial Section.—Owing to the twisting of the wood fibres, it is almost impossible to get a section showing the full height of a ray, which vary from uniseriate to multiseriate, such as are seen in Fig. LXXIV—which shows conclusively how completely the vertical sclerenchymatous ring of cells restricts them to the width of a ring only. In such a case, it seems to me impossible to call them medullary rays, for they do not come from the middle of the stem. The phloem of the broken cell contents is as conspicuous as in other sections.

Results of these Histological Investigations.

(*a*) Practically no true medullary rays, as obtain in secondary wood of dicotyledons, are found in the structure, for what must certainly be classed as rays yet are not medullary, as they do not extend from the middle to the outer cortex, being quite restricted in their length to the width of each ring.

(*b*) Bands of vertical walls of sclerenchymatous cells of the round or polygonal or short variety limit the length of the rays—a feature quite absent in any timber as far as I have been able to ascertain.

(*c*) The phloem cells in regular clusters on the outer edge of each ring appear to perform the function of ordinary exterior bark, as shown when the tree is ring barked.

(*d*) The remarkable disposition of the wood fibres.

(*e*) The work of cambium being performed apparently by the wood parenchyma between the wood fibres and the stone cells.

(*f*) There is nothing in the wood which corresponds with the spring and autumn growths of other dicotyledons.

Systematic.

The plant upon which the research is made may be described as a species attaining full tree size, with a pale coloured comparatively smooth, very thin exterior bark, not much more than one-sixteenth of an inch in thickness on the tallest trees. Branchlets angular, leaves opposite, ovate to occasionally lanceolate, mostly acute, petiole about $\frac{1}{8}$ inch long, margins slightly recurved, length about 3 inches and under, breadth varying up to $1\frac{1}{2}$ inch, shining on the upper side. Clothed with a short tomentum on the lower. Cymes in capitate heads, on fairly long peduncles in the upper axils; bracts and bracteoles small, hirsute with brown hairs, same as calyx, which is five partite, segments ovate imbricate, the two within smaller than the outer three. Corolla tube turbinate (top-shaped), lower half glabrous outside, lobes concave, hirsute, anthers not exserted. Pistil short bifurcated, hidden except the stigma in the straight erect hairs at the top of the ovary, which is glabrous and shining below this tuft of hair (supra). Ovary imperfectly four-celled, with four pendulous ovules. Capsule flattened, yellowish, dehescing by two thick valves, one seeded. Seed erect, hypocotyl villous, but the hairs have not barbed tips.

Geographical Range.

Coast of Australia.

Vitex lignum-vitæ, A. Cunn.

LIGNUM-VITÆ.

TIMBER.

DESCRIPTION AND USES.

A fine grained, hard, medium weight timber, with a facies not unlike *Ceratopetalum apetalum,* but has not the aroma of that wood. It is pale grey or pinkish in colour, with fine rays, so has no figure. It planes and dresses well and could be used for carriage and cabinet work. It is being tried for gun stocks.

There are two other species of this genus recorded by F. M. Bailey as possessing hard, close-grained timbers, viz.:—*V. acuminata,* R.Br., and *V. trifolia.* Linn.

H. = Hard. W. = 56 lb. per cubic foot.

Systematic.

A tall handsome tree, the young branches, petioles and inflorescence tomatose or pubescent. Leaves all simple (or unifoliate), oblong or oval-elliptical, shortly acuminate, narrowed at the base, 1½ to 4 inches long, on a petiole of ¼ to ½ inch, somewhat coriaceous. Flowers few, in small loose axillary cymes. Calyx truncate, about 1 line long ot rather more, rarely tomentose. Corolla tomentose outside, the tube 3 to 4 lines long, broad and incurved, the middle lower tube not exceeding the others so much as in some species. Stamens shortly exserted beyond the upper lobes. Fruit globose red, about 9 lines diameter.

Geographical Range.

North Coast, New South Wales, and Queensland Coast district, near Brisbane.

NATURAL ORDER

Monimiaceæ.

An Order with a limited number of Species, and found mostly in the Southern Continents. The two best representatives here amongst hardwoods are, *Daphnandra micrantha* and *D. repandula;* the cabinet softwoods Sassafras, *Doryphora sassafras,* and *Atherosperma moschata* are both well known.

Daphnandra micrantha, Benth.

"YELLOW WOOD."

TIMBER.

Description and Uses.

A very close, fine-grained, wavy timber, much resembling *Doryphora sassafras* in general facies, but much heavier and tougher. A strong feature is that it retains its pale canary colour after being dressed. It somewhat resembles English Beech in texture, and so would be a very suitable timber for many purposes for which that timber is used. It is strong and could be employed in some forms of yellow cabinet work. It is suitable for brush-backs and similar articles.

H. = Moderate. W. = 43 lb. per cubic foot.

Systematic.

A handsome tree of moderate size, quite glabrous or the young inflorescence minutely hoary. Leaves petiolate, oblong-lanceolate, or elliptical, acuminate, more or less serrate, contracted at the base, 3 to 4 inches long, green on both sides, the primary veins oblique and anastomising. Panicles shorter than the leaves, the flowers not numerous. Bracts scarcely 1 line long, very deciduous. Perianth-tube short and broad, outer segments broad, about 1 line diameter, inner ones narrower and more petal like. Stamens not exceeding the perianth. Carpels of the ovary glabrous or slightly hairy, sessile in the hairy receptacle.

Geographical Range.

North Coast district of New South Wales and Coastal district of Queensland.

Daphnandra repandula, F.v.M.

TIMBER.

DESCRIPTION AND USES.

Bailey describes this tree as of a light brown colour, nicely figured, and close grained. It would probably serve for engraving, and is considered to resemble the English Holly.

Systematic.

A moderate-sized tree, the young branches tomentose. Leaves thin chartaceous, 4 to 7 inches long, long-acuminate at the apex, the margins slightly repand or crenate; nerves very oblique, the upper ones distant, hairy with short hairs. Panicles axillary, very slender, about 3 inches long. Perianth minute glandular-fringed. Fruiting perianth about 9 lines long, dark, enlarged above the middle, thence tapering towards each end. Seeds fusiform, 3 lines long, covered with light brown glossy hairs as long as the seed itself.

Geographical Range.

The tropical scrubs of Queensland.

Mollinedia Huegeliana, Tul.

TIMBER.

DESCRIPTION AND USES.

A fairly hard, close-grained timber with a Proteaceæ figure, and almost similar in colour and character to *Villaresia Moorei*, New South Wales Maple, and somewhat resembling American Sycamore. It is a firm timber to work, and should be suitable for cabinet work, ornamental turnery, staves, and may be suitable for wood-working planes.

H. = Moderate. W. = 47 lb. per cubic foot.

Systematic.

A small tree, the young shoots, inflorescence, and underside of the leaves usually pubescent. Leaves on short petioles, ovate-elliptical to oblong-elliptical to oblong-lanceolate, obtuse or shortly acuminate, entire or bordered by short rigid teeth, rounded or rarely acute at the base, mostly 3 to 4 inches long, but varying to short and broad or long and narrow, more coriaceous and shining above than other species, strongly reticulate. Flowers in little cymes or thyrsoid panicles very short and sessile, or nearly so in the axils; pedicels rather long in the males with a very short common peduncle; the pedicels shorter in the females with a longer peduncle or rhachis, almost forming a few-flowered raceme of about an inch. Male perianth nearly globular, about 1 line diameter, the small orifice almost closed by four minute broad lobes, two inside the two others, and one or two outer lobes opposite the inner ones. Carpels numerous and villous. Drupes sessile on the base of the perianth or disk, expanded to a diameter of 3 or 4 lines, ovoid globose, ½ inch long, pubescent or at length glabrous.

Geographical Range.

Coastal districts of Queensland and New South Wales.

NATURAL ORDER.

Laurineæ.

REPRESENTATIVES of this Order are found in the four quarters of the Globe, but they are essentially tropical trees, for there the species and genera are more numerous. The Camphor Laurel, so extensively growing in Australia, although not a native, belongs to this order. Some of the Australian trees yield very fine hardwoods, of a characteristic, almost uniform colour and even texture, which easily differentiate them from those of other Natural Orders. Although they form a very important class in a collection of native timbers, yet they are not commonly found on the market, and so their technical application has not been exploited, except in the case of Bolly Gum (softwood) and Queensland Walnut. Nevertheless they are valuable timber trees and worthy of extensive cultivation in brushland country. They much resemble those of the Natural Order Sapindaceæ. A few are very useful for cabinet work.

SPECIES ILLUSTRATED IN COLOUR :—

Cryptocarya Palmerstoni, Bail. (Queensland Walnut).
Endiandra globosa, Maiden and Betche (Large Black Apple).

Cryptocarya Murrayi, F.v.M.

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey, Q. Fl., Vol. IV, p. 1298, describes this timber as dark coloured, hard and close grained.

Systematic.

A large tree, the young branches stout and softly tomentose-villous, more or less ferruginous. Leaves shorthy petiolate, oblong ovai or elliptical, obtuse or shortly acuminate, 6 to 10 inches long, glabrous above when full grown or the midrib minutely pubescent, very prominently penniveined and reticulate underneath, the veins rusty-pubescent, somewhat glaucous between them. Panicles short compact and villous. Flowers sessile in the cymes. Perianth hirsute, the segments rather longer than the tube (about 1 line), almost acute. Fruiting perianth ovoid or nearly globular, shining, about ½ inch diameter.

Geographical Range.

Coastal districts of Queensland.

Cryptocarya Mackinnoniana, F.v.M.

"KOONJOOGAROO."

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey, Q. Fl., Vol. IV, p. 1298, describes this wood as grey in colour, close grained and hard.

Systematic.

A noble tree of 100 feet high, the young branches, petioles, and inflorescence minutely rusty-pubescent. Leaves oblong or almost ovate, obtuse or shortly acuminate, rounded or cuneate at the base, 4 to 8 inches long, rather thick, at first minutely pubescent, at length glabrous and almost shining above, very prominently penniveined and reticulate underneath, the veins rusty-pubescent, often glaucous between them. Panicles loosely corymbose or thyrsoid. Pedicels very short. Perianth scarcely above 1 line long, the segments about as long as the tube. Fruiting perianth ovoid or oblong, about ¼ inch long.

Geographical Range.

Coastal districts of Queensland.

Cryptocarya patentinervis, F.v.M.

TIMBER.

DESCRIPTION AND USES.

A pale, brownish-coloured wood, with a sweet odour, even, and straight grain, much resembling the European Birch in general facies. Heavy, strong, and tough, a timber that could be used for a large number of purposes in technology, such as coach building, interior plain panelling (as the colour is pleasing and quiet, yet warm), railway interior and exterior uses. It resembles Ratonia and other Sapindaceous timbers.

H. = Moderate. W. = 41½ lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	8,170	5,440
Modulus of rupture in lb. per square inch ...	15,861	10,561
,, elasticity ,, ,, ...	1,875,200	2,000,000
Rate of load in lb. per minute	1,021	1,088

Systematic.

A small tree, the branches and inflorescence ferruginous or hoary, with a close tomentum. Leaves ovate to oblong-lanceolate, acuminate, 2 to 4 inches long, glabrous above, softly or minutely pubescent and more or less glaucous underneath, the primary veins prominent, the reticulate veinlets also somewhat conspicuous. Cymes sometimes solitary in the axils, more frequently several in short terminal thyrsoid panicles, the flowers not numerous, hoary pubescent. Perianth 1½ line long. Fruiting perianth ellipsoid-oblong, nearly ½ inch long, the pericarp rather more distinct from it than in most species.

Geographical Range.

The Tweed River district of New South Wales, and Queensland.

Cryptocarya obovata, R.Br.

TIMBER.

DESCRIPTION AND USES.

This is perhaps the palest-coloured wood of the genus, and often has a large wavy figure, with a tint bordering on that of the English Oak, so that it is quite a decorative timber. It is hard, close grained and interlocked, and could be used for coach and carriage work, and general purposes. Medullary ray very fine in end section.

It closely resembles Nephelium and other Sapindaceous timber.

H. = Moderate. W. = 51½ lb. per cubic foot.

Systematic.

A fine bushy-headed tree, the young shoots and inflorescence minutely tomentose and more or less ferruginous. Leaves oblong to obovate, very obtuse, and 2 to 4 inches long in the typical form, larger, broader, and sometimes shortly and obtusely acuminate; in northern specimens, rather thick, the margins often recurved, glaucous, with the veins scarcely conspicuous above, often glaucous or even minutely pubescent when young underneath, with the primary pinnate veins very prominent, the reticulations scarcely conspicuous. Panicles loosely thyrsoid, numerous and many-flowered, the upper ones forming a terminal panicle. Flowers rather larger than in *C. glaucescens*. Perianth-segments as long as the oblong tube. Fruiting perianth globular, about 1½ inch diameter.

Geographical Range.

Coastal districts of New South Wales and Queensland.

Cryptocarya glaucescens, R.Br.

"BROWN BEECH," "BLACK PINE," "BROWN PINE," "BLACK SASSAFRAS."

TIMBER.

DESCRIPTION AND USES.

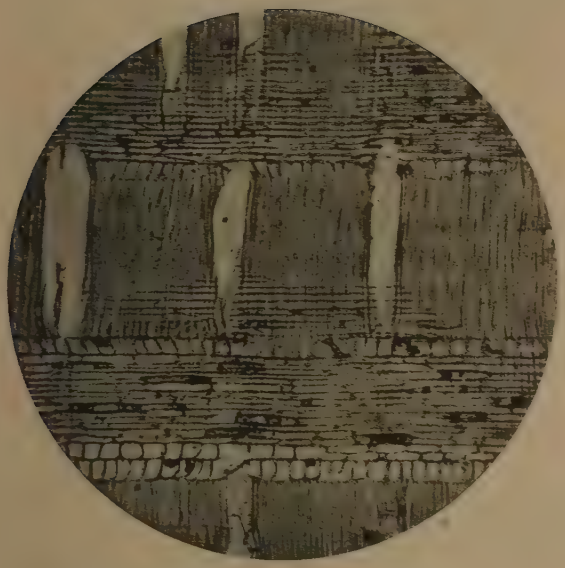
A straight-grained timber with a characteristic figure produced by some of the rays becoming enlarged. These multiseriate rays produce big indentations below the bark. When planed, somewhat resembles English or Japanese Oak in certain cases. It is a pale grey in colour, and has a white deposit in some of its wood elements. It is a splendid, generally useful timber, and one of the brush trees that should be reafforested.

It would be very attractive in panelling in a study of grey, and could also be used for furniture, carriage work, and many economics not yet found for it.

H. = Moderate. W. = 44 lb. per cubic foot.

FIG. LXXV.

CROSS SECTION, showing rows of fibres and rays with and without cell content; two bands of wood parenchyma are seen extending across the field below the centre; two kinds of ray cells are seen.



Micro. photo.]

RADIAL SECTION, showing heterogeneity of rays; and vessels separated by compact fibres.

[*T. C. Roughley.*

TANGENTIAL SECTION, showing variability in the size of rays; several vessels, and fibres.

CRYPTOCARYA GLAUCESCENS. R.BR.

ANATOMICAL FEATURES.

The sections examined showed an unusual feature in that the wood parenchyma in some instances instead of running parallel to other wood elements, as obtains in most species of timbers, was disposed in curves, and in some cases ran with the rays, the effect being in a transverse section the cells were cut in their long axis, and in a longitudinal one transverse, otherwise they run in bands of three or four cells wide amongst the fibres or scattered singly. The fibres have walls of medium thickness with a very fair sized lumen, and wall perforations. The vessels are fairly numerous with distinct partition walls and an absence of tyloses. The numerous rays range from uniserate to multiseriate and have two forms of cells, the inner with the long axis horizontal and the outer with the long axis vertical. No deposits were seen.

Systematic.

[illegible] shortly contracted at the base, flat, not usually so rigid as in *C. obovata*, [illegible]-veined and reticulate, but the veins rather fine and the reticulations little conspicuous or in some varieties conspicuous or even prominent on both sides, both surfaces green or somewhat glaucous, rarely above 4 inches long in flowering specimens. Inflorescence usually hoary-pubescent. Flowers numerous, shortly pedicellate in thyrsoid panicles, shorter or larger than the leaves. Perianth 1 to 1½ line long, hoary pubescent. Fruiting perianth depressed, globular, ½ to nearly ¾ inch diameter.

Geographical Range.

The Coast districts and Dividing Range of New South Wales, and the Coastal areas of Queensland.

Cryptocarya triplinervis, R.Br.

TIMBER.

DESCRIPTION AND USES.

One of the finest timbers of the Natural Order, having a palish brown colour not unlike *C. patentinervis* in that respect. It is close, straight grained, and works easily, having a slight sheen. A good average all-round timber for cabinet and carriage work, and many other industries. It is a tree deserving of consideration in forestry plantations.

H. = Hard. W. = 51 lb. per cubic foot.

Systematic.

A tall tree, leaves ovate-elliptical or oblong-lanceolate acuminate, glabrous above, more or [illegible] pubescent underneath, rarely above 4 inches long, triplinerved or more or less irregularly reticulated with [illegible] [illegible] [illegible]

Cryptocarya Palmerstoni, Bail.

"QUEENSLAND WALNUT." Plate III.

TIMBER.

Description and Uses.

The botanical origin of this wood is rather in doubt at the present time, but as it is a good commercial timber it is described here. It is fairly heavy, of a chocolate colour, approaching English and American Walnut, rather open in the grain, planes and dresses well, takes a good polish, and possesses a fine figure, and hence ranks as a first-class cabinet timber, its position in this direction being due, amongst its other qualities, to its quick seasoning. It is altogether a good useful joinery and cabinet wood, but is capable of utilisation in other directions where strength is required. It is an excellent substitute for American Walnut.

H. = Moderate. W. = 46 lb. per cubic foot.

Systematic.

A tree of a large size, attaining a height of over 100 feet. Leaves alternate, oval-oblong, [illegible] tapering at the base, [illegible] upper surface glabrous and shining, with a tomentum on the lower side; primary veins prominent, secondary veins indistinct. Fruit about 1¼ inches long and about the same in diameter, with longitudinal corrugations, pericarp hard and brittle, enclosing a round free nut of more than 1 inch diameter.

Geographical Range.

Coastal districts of Northern Queensland.

Beilschmiedia obtusifolia, Benth.

"BOLLY GUM," "SHE BEECH," "POMATUM WOOD," "SCALY BEECH."

TIMBER.

Description and Uses.

A dull, pale-brown coloured, fairly heavy timber, wavy short grained, difficult and tough to work, but has rather an undue proportion of sapwood, which is readily attacked by wood borers, and this, of course, detracts from its merits. It is useful for heavy works of all kinds

H. = Hard. W. = 46 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2	No. 3.
Breaking load in lb.	3,000	3,580	4,370
Modulus of rupture in lb, per square inch ...	6,163	7,508	9,131
,, elasticity ,, ,, ...	1,163,500	1,376,380	1,341,900
Rate of load in lb. per minute	750	716	728

Systematic.

A large and handsome tree, the young shoots and inflorescence sprinkled with minute appressed hairs, otherwise glabrous. Leaves elliptical-oblong or oval-oblong, obtuse or obtusely-acuminate, narrowed at the base into a short petiole, rather rigid, green on both sides, penniveined and loosely reticulate, 2 to 4 inches long. Cymes large and rather broad, the upper ones in a broad pyramidal or almost corymbose terminal panicle. Pedicels thick and ½ line long above the small bracteoles. Perianth-tube very short and broad, the segments 1 line long. Stamens opposed to the outer segments broad, those opposed to the inner ones narrow. Berry elliptical-oblong, the whole perianth deciduous.

Geographical Range.

The Queensland Coast districts and the Northern brush forests of New South Wales.

Endiandra glauca, R.Br.

TIMBER.

DESCRIPTION AND USES.

The wood is light coloured, close grained, hard and tough (Bailey).

Systematic.

A brush tree, the young shoots and inflorescence minutely ferruginous tomentose. Leaves elliptical-oblong, acuminate, contracted at the base, mostly 3 to 5 inches long, glabrous and green above, glaucous or white underneath, otherwise glabrous or the very prominent primary veins minutely ferruginous-tomentose. Panicles thyrsoid, rather loose, shorter than the leaves, the bracts small and very deciduous. Pedicels short. Perianth-tube turbinate, much narrower than the limb, which spreads to 2 or 2½ lines diameter. Fruit black, oval, ½ inch long.

Geographical Range.

The Northern Rivers and Coast districts of Queensland.

Endiandra discolor, Benth.

"MURROGUN."

TIMBER.

DESCRIPTION AND USES.

A splendid timber, and like the rest of the genus, worthy of forest cultivation. It is light brown in colour, close, straight grained, with a centre marked by a dark ring, and suitable for all kinds of heavy work, being eminently adapted for this purpose. The medullary rays are very

PLATE 111.

QUEENSLAND WALNUT.

(*Cryptocarya Palmerstoni*, R.Br.)

PLATE 112.

LARGE BLACK APPLE.

(*Endiandra globosa* Maiden & Betche.)

numerous and fine, almost invisible; the annual rings are not distinct. It is only a moderately hard timber, but is fairly tough to work, and should be suitable for carriage framing and panelling, light coach and waggon work, turnery, joinery and cabinet work.

H. = Moderate. W. = 47 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	9,230	7,460
Modulus of rupture in lb. per square inch ...	17,919	14,482
,, elasticity ,, ,, ...	1,967,600	1,936,000
Rate of load in lb. per minute	1,153	1,243

Systematic.

A tall forest tree, the young branches and inflorescence minutely hoary-tomentose. Leaves ovate or elliptical, obtuse or shortly acuminate, 2 to 3 inches long, green and glabrous above, glaucous or white underneath, with a few prominent primary veins, the smaller reticulations conspicuous on both sides in the full grown leaf. Panicles thyrsoid, much shorter than the leaves, the pedicels very short. Perianth-tube small and turbinate, the limbs very open, about 1½ line diameter, with ovate segments. Stamens of the outer row entirely deficient, of the inner series three, with sessile glands at their base and alternating with three small staminodia. Fruit ovoid-oblong, ¾ to 1 inch long, resting on the unenlarged remains of the perianth.

Geographical Range.

Albany Island and Cape York and the more southern Coastal scrubs of Southern Queensland into New South Wales

Endiandra virens, F.v.M.

"SWAMP ROSEWOOD."

TIMBER.

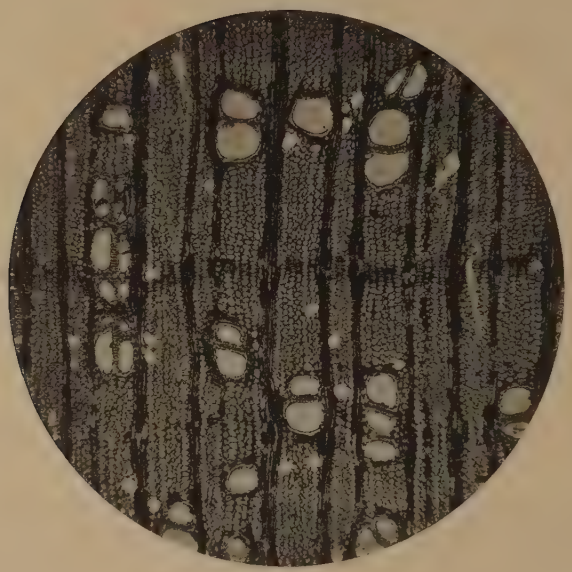
DESCRIPTION AND USES.

A light-brownish or grey-coloured, straight, close-grained timber, strong, and heavy; a splendid hardwood, adapted for large constructional waggons, carriage and coach work, bridges, sleepers, certain parts of shipbuilding, panelling, and other economics.

A tree, like the rest of the genus, that should be extensively cultivated on forest brush lands, being a good average timber for general purposes. It is difficult to explain the use of the word Rosewood here, as the wood in no way possesses the characters of *Dysoxylon Fraserianum*, the Rosewood of the trade.

H. = Hard. W. = 54 lb. per cubic foot.

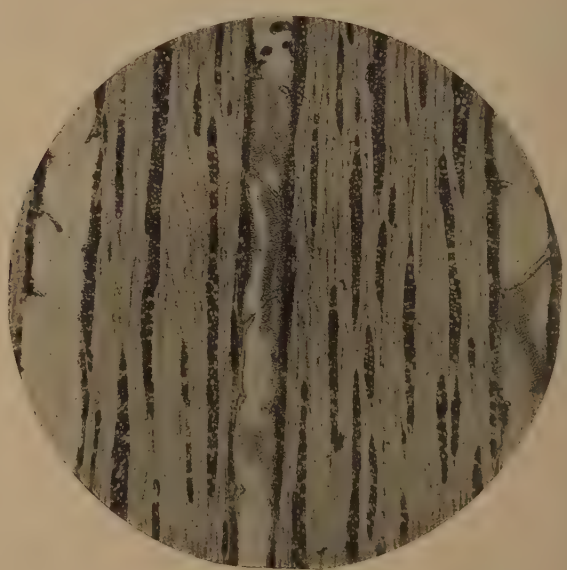
FIG. LXXVI.



CROSS SECTION, showing numerous, conjugate, thick-walled pores; pronounced rays with their dark deposit; and regular lines of fibres. A band of wood parenchyma across the centre.

Micro. photo.]

RADIAL SECTION, through portions of two heterogeneous rays, nearly all the cells having a deposit; dense wood fibres and portions of vessels.



[*T. C. Roughley.*

TANGENTIAL SECTIONS, showing rays of varying heights; vessels with septa and ordinary bordered pits.

ENDIANDRA VIRENS, F.V.M.

ANATOMICAL FEATURES.

The main features of difference between this timber and that of *Cryptocarya glaucescens* described, is that the rays have only the cells with a long axis horizontal and nearly all the cells contain a dark deposit. Again the walls of the wood parenchyma are richly endowed with pitted cells.

Systematic.

A tree attaining a considerable height, glabrous in all its parts. Leaves oblong, usually narrow, rarely broad, and elliptical, obtuse, contracted at the base, 2 to 3 inches long in some specimens, twice that size in others, not thick, green and reticulate on both sides, somewhat shining above, a few of the primary veins more prominent than the others. Panicles slender, glabrous, much shorter than the leaves. Pedicels rather long. Flowers small. Perianth-tube very thick, broadly turbinate, nearly 1 line diameter, forming a thick projecting ring round the base of the lobes, which are shorter than the tube, broad and connivent, the three inner ones rather smaller than, and quite enclosed in, the outer ones. Stamens of the outer row entirely deficient, of the inner row three without glands at their base, but alternating with sessile staminodia. Fruit globular, ½ to ¾ inch diameter.

Geographical Range.

Common along the creek sides on the East Coast of New South Wales and Queensland.

Endiandra Sankeyana, Bail.

"GOOLAMAY."

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey states, Q. Fl., Vol. IV, p. 1307, that the wood is of a greenish colour, hard and tough; a useful building timber.

Systematic.

A tree attaining a height of about 70 feet; the young branches often four-angular and more or less densely ferruginous, velvety tomentose. Leaves alternate or subopposite at the ends of the branchlets, from elliptical-oblong to lanceolate, the larger ones 5 inches long and 2½ inches broad in the widest part, shortly petiolate, the upper surface glabrous, the primary veins sunk, under surface pale, with the primary and reticulate veins very prominent, of a reddish-brown and more or less velvety. Flowers not seen. Fruit black, globose, often compressed, 1 to 1½ inch diameter, resting upon a star-like perianth, not exceeding 2 lines diameter.

Geographical Range.

The scrubs about the Barron River district, Queensland.

Endiandra pubens. Meissn.

TIMBER.

DESCRIPTION AND USES.

A fairly hard, pale-brown coloured timber, darkening towards the centre. It is close grained, firm and tough, with a small radial figure. In an end section the medullary rays are almost invisible and the annual rings are fine and numerous. The timber does not open or warp much in seasoning. It should be suitable for coach and carriage building, interior joinery, flooring, cabinet and chair work.

H. = Hard. W. = 49 lb. per cubic foot.

Systematic.

A large tree, the branches and petioles more or less velvety-tomentose and ferruginous. Leaves oval to elliptical-oblong, obtusely acuminate or almost obtuse, narrowed at the base, 4 to 8 inches long, glabrous above, prominently veined and pubescent or villous underneath. Panicles axillary, or broadly thyrsoid, usually about 1 inch long, sometimes more branched and half as long as the leaves, sometimes very short, more or less ferruginous-hirsute. Fruit globular, $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter.

Geographical Range.

Found in the Brisbane River district, and Moreton Bay, Queensland.

Endiandra globosa. J.H.M.

"LARGE BLACK APPLE." Plate 112.

TIMBER.

DESCRIPTION AND USES.

A very close-grained, light-brown coloured, exceedingly hard and heavy interlocked timber, much resembling some of the hardest of the Sapindaceæ. It is difficult to work, but is nevertheless a splendid timber for heavy constructional work, carriages, waggons, and sleepers—being the hardest of the genus—and should be afforested for our future supplies of timber. Medullary rays exceedingly fine and numerous.

H. = Very Hard. W. = 68 lb. per cubic foot.

Systematic.

A tall straight-stemmed tree, glabrous in all its parts, except minute hairs on the inflorescence. Leaves ovate-elliptical, acuminate but obtuse, 5 to $5\frac{1}{2}$ inches long, and 2 to nearly 3 inches broad, finely reticulate and equally green on both sides, narrowed into a short petiole. Panicles, in the few specimens seen, much less than half as long as the leaves. Calyx (or perianth) tube small, the limb very open, consisting generally of six broad segments. Stamens: three fertile ones alternating with three short thick rudimentary ones, and a large scale-like gland on each side of the fertile stamens. Ripe fruits perfectly globular, 2 inches in diameter, resting on a short thick pedicel, with a thin pericarp and a hard woody endocarp.

Geographical Range.

The North Coast district of New South Wales and the South Coast of Queensland.

Persea Baileyana, F.v.M.

"CANDLEWOOD OF FRASER'S ISLAND."

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey, Q. Fl., Vol. IV, p. 1310, describes the timber as of a dark-grey colour, close grained, and slightly fragrant.

Systematic.

A tree attaining the height of about 60 feet, glabrous except in the inflorescence. Leaves opposite, or here and there alternate, ovate or ovate-lanceolate, 2 or 3 inches long, on petioles of about ¼ inch long, green on both sides, prominently triplinerved and finely reticulate, most conspicuous on the underside. Inflorescence terminal on the upper axils, forming short trichotomous panicles, or more or less racemose, bearing distant few-flowered clusters. Perianths silky-white, on short pedicel segments about 2 lines long.

Geographical Range.

Fraser's Island, Queensland.

NATURAL ORDER.

Proteaceæ.

A FAIRLY well distributed family of plants in the Southern Hemisphere, but it is in Australia where by far the largest section is found. Apart from the remarkable beauty and singularity of their flowers, the timbers here are famous for their decorative feature, due to the unusual development of the medullary rays. The majority, however, are classed as softwoods, or at least do not attain the lowest standard of hardness laid down in this work, although they come very close to it, but nevertheless, although excluded, are woods of some strength such as *Grevillea robusta*, Silky Oak, and *Orites excelsa*, Silky Oak or Prickly Ash.

SPECIES ILLUSTRATED IN COLOUR :—

Macadamia ternifolia, F.v.M. (Queensland Nut).
Grevillea striata, R.Br. (Beefwood).
Telopea oreades, F.v.M. (Victorian Waratah).

Macadamia ternifolia, F.v.M.

"QUEENSLAND NUT." Plate 113.

TIMBER.

DESCRIPTION AND USES.

This is a very heavy, extremely hard, close-grained, strong timber, with the usual prominent ray figure of the Natural Order, and as it is chocolate in colour, these features commend it to cabinet makers for the heavier work. It is very tough, and of a greasy nature to work. It is suitable, however, for works requiring strength, such as constructional, heavy waggons and carriages and turnery. Care must be taken to remove the sapwood, which is pronounced, and attractive to borers.

H. = Extremely Hard. W. = 75 lb. per cubic foot.

Systematic.

A tall tree (typical form) with a very dense foliage, glabrous, or the young branchlets and inflorescence minutely pubescent. Leaves sessile or nearly so, in whorls of three or four, or some opposite, oblong or lanceolate, acute or obtuse, serrate with fine or prickly teeth, or quite entire, from a few inches to 1 foot long. Racemes as long as the leaves, with numerous short flowers, the pairs almost clustered or almost verticillate. Fruit with a two-valved coriaceous exocarp; endocarp smooth and shining, thick and bony, seeds often above 1 inch diameter, globular or two and hemispherical.

Geographical Range.

Coast district of Queensland, and North Coast district of New South Wales.

PLATE 113

QUEENSLAND NUT.

(*Macadamia ternifolia* F.v.M.)

PLATE 114.

BEEFWOOD.

(*Grevillea striata*, R.Br.)

Macadamia prælta, Bail.

"SCRUB HONEYSUCKLE."

TIMBER.

DESCRIPTION AND USES.

Bailey states, Ql. Fl., Vol. IV, p. 1330, that the wood is of a red colour, nicely marked, close in the grain, tough, strong and durable; useful for cabinet work, handles of tools, and other purposes.

Systematic.

A moderate-sized or sometimes a lofty tree, glabrous except the inflorescence which is often minutely tomentose. Leaves lanceolate, usually narrow, obtuse or acuminate, contracted into a petiole, quite entire, only 3 or 4 inches long in a few specimens, mostly 6 to 10 inches in others, coriaceous, often shining, penniveined and reticulate, the veins fine. Racemes axillary or lateral, 3 to 6 inches long, the rachis rigid. Pedicels 2 to 3 lines long, united to above the middle. Perianth 7 to 8 lines long. Hypogynous glands quite distinct and narrow. Ovary glabrous. Fruit globular, 1 to 2 inches diameter, two-valved; exocarp coriaceous; nuts globose or towards hemispherical; endocarp somewhat rugose, bony, but not very thick.

Geographical Range.

Southern scrubs of Queensland, generally on mountain sides.

Grevillea striata, R.Br.

"BEEFWOOD." Plate 114.

TIMBER.

DESCRIPTION AND USES.

This timber is characterised by a pronounced Oak figure of a deep red colour, from which it takes its vernacular name. The tree attains a fair height, so that some good flitches can be produced. The grain is rather open, but very hard; the timber dresses well and takes a good polish, is very heavy, and for decoration in heavy cabinet work would be very suitable, but so far has not been used in the trade, and being not too common, is seldom found in the Eastern markets. It is a magnificent timber for decorative purposes of all kinds, turnery, cabinet work, ornamental boxes, brushes, cutlery and scientific instrument cases, also wood-working planes.

H. = Very Hard. W. = 67 lb. per cubic foot.

Systematic.

A large tree with a great geographical range, found on the north and east coast and extending into the dry interior of the continent, with a rough, thick, furrowed bark. Leaves undivided, linear or linear-lanceolate, 6 to 18 inches long, often curved, from under $\frac{1}{4}$ to over $\frac{1}{2}$ inch broad, striate underneath, with nine to thirteen raised parallel nerves. Flowers small, in slender spike-like erect racemes of 2 or 3 inches, shortly pedunculate, and usually several together in a leafless panicle shorter than the leaves, the rachis tomentose. Fruit broad, very oblique, compressed, about $\frac{3}{4}$ inch long.

Geographical Range.

With the exception of Tasmania, found in all the States.

Grevillea Hilliana, F.v.M.

"RED SILKY OAK."

TIMBER.

Description and Uses.

One of the finest hardwoods of this Natural Order, much resembling in texture and colour, in fact, almost a replica of, *G. striata* or *Stenocarpus salignus*.

It is close-grained, deep red in colour, with, like the rest of the Natural Order, a pretty figure whichever way cut. A very beautiful timber under polish, and very suitable for heavy cabinet work, turnery, and possesses a natural greasiness which may make it of use in some new industrial direction.

H. = Hard. W. = 62 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

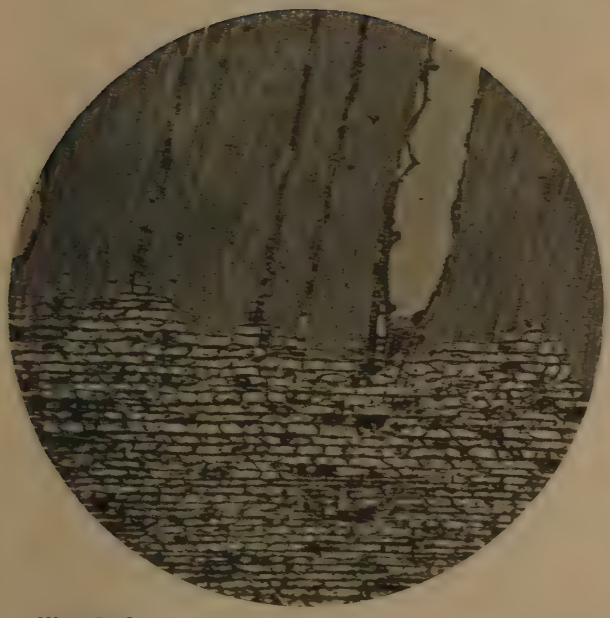
	No. 1.	No. 2.	No. 3.
Breaking load in lb.	9,760	9,440	9,660
Modulus of rupture in lb. per square inch ...	19,520	18,880	19,320
,, elasticity ,, ,, ...	2,964,705	2,677,640	2,734,177
Rate of load in lb. per minute	813	944	805

Anatomical Features.

In a transverse section a very beautiful figure is obtained when stained with malachite green, the rays form attractive green bands across the field of varying thickness according to the number of cells, many of which contain a deposit in an amorphous form or spherical. Between these occur wood parenchyma, fibre and vessels, the first two arranged in concentric loops concave always towards the bark. The fibres occupy by far the biggest area being only separated by the narrow band of wood parenchyma, one, two or three cells wide. The walls of the fibres are very thick and so only a very small lumen obtains; the cell walls are not numerous. The wood parenchyma cells have the long axis in some few instances in the arc of their disposition and are almost all filled with a coloured deposit, which makes them still more conspicuous. The vessels are irregularly distributed throughout.

FIG. LXXVII.

TRANSVERSE SECTION, showing four rather [illegible] arrangement of parenchyma between masses of fibres, concave toward the bark; scattered pores.



Micro. photo.]

RADIAL SECTION, showing portion of large ray at bottom; the upper portion composed of fibres, wood parenchyma and portions of two vessels.

[T. C. Beveridge.

TANGENTIAL SECTION, showing multiseriate ray in the centre; wood parenchyma to left of this in longer part; portions of four vessels and a few uniseriate rays.

GREVILLEA HILLIANA. F.v.M

A radial section clear of the rays shows a rather regular structure, the columns of fibres alternating with the parenchyma and vessels. The rays, especially the multiseriate ones, are very pronounced and show globular and amorphous cell contents, the former occurring in the cells of the wood parenchyma and in the vessels, the only species in which they were so found in the latter. Silica was also detected.

In a tangential section the compact mass of fibres and spindle-shaped end-on view of the large and small rays, with their varied cell contents are characteristics of this view.

Systematic.

A large tree, the young branches minutely tomentose. Leaves petiolate, either entirely obovate-oblong or elliptical, very obtuse, tapering at the base and 6 to 8 inches long or still longer and deeply divided at the end into two or three diverging lobes pinnatifid with five to seven oblong- or lanceolate lobes of several inches, the whole leaf then sometimes above 1 foot long, glabrous above, penniveined and reticulate with the primary veins confluent in an intramarginal nerve, more or less silvery-silky underneath. Flowers small and very numerous in dense cylindrical racemes of 4 to 8 inches, on short axillary shoots accompanied often by one or two smaller. Fruit slightly compressed, nearly 1 inch long. Seed rather narrow, winged all round.

Geographical Range.

Coastal districts of Queensland, also North Coast of New South Wales.

Hakea saligna, R.Br.

"FOLEY WOOD."

TIMBER.

DESCRIPTION AND USES.

Similar in figure and character to *Telopea oreades*. It is only obtainable in rather small sizes, the tree having an average diameter of about 8 inches, and a height of 30 feet. Suitable for small turnery and other ornamental work.

H. = Moderate. W. = 44 lb. per cubic foot.

Systematic.

A tall bushy shrub quite glabrous or the young shoots slightly silky. Leaves usually lanceolate, obtuse, or with a short callous point, tapering into a short petiole, 3 to 6 inches long, but sometimes oblong-elliptical and 2 to 4 inches long, of a pale colour, veinless or obscurely and obliquely penni-veined. Flowers small, in dense axillary clusters, the very short rachis hirsute. Fruit about 1 inch long, $\frac{1}{2}$ to $\frac{3}{4}$ inch broad, with a short incurved beak, more or less rugose and sometimes covered with large, very prominent tubercles. Seed-wing shortly decurrent along the upper margin of the nucleus.

Geographical Range.

Coastal districts of Queensland and the ranges adjoining.

Hakea lorea, R.Br.

A WESTERN "CORK-TREE."

TIMBER.

DESCRIPTION AND USES.

This timber is similar to *Hakea leucoptera* except for weight, and the description under that timber will apply equally well here.

H. = Hard. W. = 71 lb. per cubic foot.

Systematic.

A tall shrub or tree attaining a height of 20 feet. Leaves terete, smooth, and often above 2 feet long and rarely under 1 foot, very rarely (on barren branches or young plants) a few once or even twice forked or trifid. Racemes cylindrical in the upper axils, sometimes forked or in a terminal cluster, rather dense, from under 3 inches to fully 6 inches long, the rachis, pedicels, and perianths densely pubescent with short hairs, somewhat appressed. Perianth-tube nearly 4 lines long, slightly dilated below the middle, revolute upwards. Style long, with a very oblique, broadly conical stigmatic disk. Fruit 1¼ inch long, ovate, somewhat flattened, and about ¾ inch broad the flat way.

Geographical Range.

Inland districts of all the States.

Hakea leucoptera, R.Br.

"NEEDLEWOOD."

TIMBER.

DESCRIPTION AND USES.

A reddish-brown coloured timber, close grained, hard and tough, with a pretty, small, silver grain resembling *Stenocarpus salignus*, "Beefwood." Not being a big tree the timber is only suitable for small articles needing a decorative timber. It has been tried for tobacco pipes, but owing to the presence of resin in its wood elements it has not given satisfaction.

H. = Hard. W. = 55 lb. per cubic foot.

Systematic.

A shrub with rather slender virgate branches, minutely hoary-pubescent. Leaves terete, smooth, mucronate with fine straight rigid points, more or less attenuate at the base, 1½ to 3 inches long. Flowers small, in short racemes or clusters, pedunculate in the axils or rarely terminating short leafy branches, the peduncle and rachis minutely silky-pubescent, ½ to ¾ inch long. Pedicels glabrous, 2 to 2½ lines long. Fruit about 1 inch long, ½ to ¾ inch broad, often somewhat verrucose, with a short conical beak, the valves without any or with scarcely prominent dorsal protuberances at the end. Seed-wing more or less decurrent along the upper margin only of the nucleus.

Geographical Range.

Inland districts of Queensland and New South Wales.

Hakea pedunculata, F.v.M.

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey states, Q. Fl., Vol. IV, p. 1348, that this wood is dark brown in colour, close in the grain, nicely marked, and hard.

Systematic.

Leaves soon glabrous, spathulate-oblong, with a conspicuous petiole; veins faint. Umbels axillary on slender peduncles, slightly silky. Flowers small on pedicels the length of the flowers or longer. Fruit lanceolate-ovate, nearly smooth, the pointed apex nearly straight. Seed-wing acute and but slightly decurrent along the nucleus.

Geographical Range.

Endeavour River, Queensland.

Telopea oreades, F.v.M.

VICTORIAN "WARATAH." Plate 115.

TIMBER.

DESCRIPTION AND USES.

This is one of our most beautiful Australian ornamental timbers. In figure, character, and texture it is a replica of the American Sycamore, so much admired in light-coloured suites of furniture, and so largely used in veneers for decorative work. At one time the latter timber was much in vogue for picture frames, but is not now so used. It is a close-grained, medium weight, light-coloured timber, which planes and polishes well, and only requires to be better known to be appreciated in the various trades.

H. = Moderate. W. = 45 lb. per cubic foot.

Systematic.

A fair-sized tree with a very thin, fairly smooth, dark-coloured bark. Leaves on the young plants large, a foot long and nearly 3 inches wide, oblanceolate, acuminate, much narrowed towards the base. A few of the main veins prominent, glabrous, pale on the under side. Normal leaves alternate, obovate-oblong, entire, 4 to 8 inches long, tapering into a long petiole, glaucous underneath. Flowers crowded in a large terminal crimson head-like raceme, surrounded by comparatively small coloured involucral bracts, under 1 inch long. Perianth glabrous, over 1 inch long. Fruit a recurved coriaceous follicle about 5 inches long.

Geographical Range.

Southern Coast district of New South Wales, extending to Gippsland, Victoria.

PLATE 115.

VICTORIAN WARATAH.

(*Telopea oreades*, F.v.M.)

PLATE 116.

BRUSH IRONBARK.

(*Bridelia exaltata*, F.v.M.)

Stenocarpus salignus. R.Br.

"BEEFWOOD."

TIMBER.

Description and Uses.

This species yields one of the hardest woods of the Order, being fairly close-grained, and having a very dark red colour; in both these features it much resembles *Grevillea Hilliana*. Like the rest of the Natural Order, the rays form a characteristic marking whichever way the timber is cut. Could be used for the heavier parts of carriages, waggons, and heavy cabinet work; turnery, and other uses where a decorative timber is required.

H. = Hard. W. = 51 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	8,800	8,590	9,330
Modulus of rupture in lb. per square inch ...	17,082	17,180	18,660
,, elasticity ,, ,, ...	.....	2,117,600	2,304,100
Rate of load in lb. per minute	586	1,073	1,036

Systematic.

A moderate sized tree, glabrous or the inflorescence minutely pubescent. Leaves in the typical form ovate-lanceolate or elliptical, acute, acuminate or rarely obtuse, tapering into a short petiole, 2 to 4 inches long, varying from penniveined to triplinerved, (the lower primary veins scarcely longer or much longer and thicker than the others), but the veins usually indistinct, slightly prominent or almost immersed, a few leaves on young trees or barren branches larger and pinnatifid. Peduncles slender, terminal or in the upper axils, usually shorter than the leaves, bearing a single umbel of ten to twenty flowers or in luxuriant specimens as many as thirty flowers. Fruits narrow, several inches long, closely packed.

Geographical Range.

The Coastal districts of New South Wales and the South Coast of Queensland.

58699—Z

NATURAL ORDER.

Euphorbiaceæ.

A WIDELY distributed Natural Order over the Globe and well represented in the Australian Flora. The economics of the Order are very varied and not least amongst them is timber. The best known, perhaps, is *Buxus sempervirens*, Box, of Europe.

The Australian genera yield some first-class hardwoods, the principal being here described.

SPECIES ILLUSTRATED IN COLOUR :—

Bridelia exaltata, F.v.M. (Brush Ironbark).
Dissiliaria balogioides, F.v.M. (A Teak).
Mallotus Philippinensis, Muell. Arg. (Kamala).
Baloghia lucida, Endl. (Brush Bloodwood).

Petalostigma quadriloculare, F.v.M.

"BITTER BARK."

TIMBER.

DESCRIPTION AND USES.

A heavy, hard, close-grained, brown or "Tallow-wood" coloured timber, with white but firm sapwood of about 1 inch in width, and small fiddle-back figure showing plainest in the sapwood.

H. = Hard. W. = 65 lb. per cubic foot.

Systematic.

A moderate sized tree, the branches and underside of the leaves closely silky or more loosely tomentose. Leaves shortly petiolate, in the typical form ovate or sometimes almost orbicular, very obtuse or almost acute, ½ to 1½ inch long, becoming glabrous above when old. Male flowers several together on very short pedicels. Perianth-segments orbicular or broadly ovate, silky-pubescent or villous, varying from scarcely more than 1 line to nearly 2 lines long. Branches of the styles cuneate, more or less undulate, and crenate. Fruit orange-coloured, often ½ inch diameter. Seeds slightly compressed, smooth.

Geographical Range.

The North Coast district of New South Wales and the Coastal districts of Queensland.

Phyllanthus Ferdinandi, F.v.M.

"PENCIL CEDAR" OR "WATER GUM."

TIMBER.

DESCRIPTION AND USES.

A hard, fairly close-grained, interlocked timber, with a brown colour, lighter in the outer portion or the secondary wood, with a very small radial figure or silver grain. It is hard and tough, but should be suitable for carriage and coach building, certain parts of cabinet making, such as table legs, chairs, &c., and interior joinery or carpentry work.

H. = Moderate. W. = 50½ lb. per cubic foot.

Systematic.

A small tree, quite glabrous in the typical form except the ovary. Leaves shortly petiolate, elliptical or ovate-lanceolate, more or less acuminate, often obliquely contracted at the base, usually somewhat coriaceous and shining on the upper side, 2 to 4 inches long. Flower-clusters in the typical form, sessile in the axils, pedicles, 2 to 3 lines long. Male perianth-segment nearly 2 lines long. Anthers three or rarely four, linear, erect on a very short central column, with the connective very shortly produced above the parallel cells. Female perianth smaller than in the male, with narrower segments. Capsules glabrous or nearly so, orbicular, five to seven celled, and much compressed in the centre in the typical form, slightly furrowed between the cells, about ½ inch diameter when fully ripe.

Geographical Range.

Northern Australia, also the Coastal districts of Queensland and Islands adjacent, and North Coast district of New South Wales.

Hemicyclia Australasica, F.v.M.

"YELLOW TULIP."

TIMBER.

DESCRIPTION AND USES.

A hard, pale yellowish grey timber, with a very close, straight grain and no prominent figure. On the end section the medullary rays are almost invisible; the annual rings are close and compact. It is a good, firm-working timber, and should be suitable for various purposes in the cabinet trade where figure is not essential, such as table legs, chair work, &c. The timber should also be suitable for carriage and coach body parts, interior joinery purposes, flooring and turning.

H. = Hard. W. = 54 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.
Breaking load in lb.	5,420	7,130
Modulus of rupture in lb. per square inch ...	10,840	14,260
„ elasticity „ „ ...	1,674,400	1,846,150
Rate of load in lb. per minute	1,084	1,184

Systematic.

A spreading tree attaining 40 feet, rarely reduced to a shrub, the young shoots slightly pubescent, but soon becoming glabrous, sometimes rather glaucous. Leaves petiolate, from broadly ovate to ovate-oblong, obtuse, coriaceous, often shining above, finely veined underneath, 1½ to 3 inches long. Flowers solitary or few together in axillary clusters, or the males sometimes forming short racemes with a rhachis from under 1 line to 3 or 4 lines, the pedicels 1 to 2 lines long in the males, rather longer in the females. Male perianth-segments broad and concave, especially the inner ones, 1½ to 1⅔ line long. Stamens varying from five to ten on the same specimen. Female perianth rather larger than the male. Fruit ovoid-globular, 5 to 6 lines long, very smooth, red and succulent, with a bony endocarp.

Geographical Range.

Coast districts of Queensland, Islands of Torres Straits, and North Coast district of New South Wales.

Bridelia exaltata, F.v.M.

"SCRUB IRONBARK." Plate 116.

TIMBER.

Description and Uses.

A not uncommon timber in the Sydney market, passing under the name of Brush Ironbark. It is a good timber, of a chocolate colour, hard, close grained, and planes well, possessing a sheen; seasons readily; suitable for carriage and coach parts, shipbuilding, and general constructional works.

H. = Hard. W. = 56 lb. per cubic foot.

Anatomical Features.

The fibres are the predominating features in a transverse section, being closely packed, in radial rows, or without any particular arrangement; the walls are thick with few, if any, perforations, and the lumen is quite restricted. The pores are fairly well scattered, as also are the wood parenchyma cells, amongst the fibres. The wood parenchyma has often crystals of calcium oxalate, as well as a brownish deposit in the cells, and occasionally these are found in a few of the ray cells.

The vessels are rather short celled with tyloses here and there. The rays are numerous, of one and two cells wide, and not many in height.

The most characteristic section is the radial, which shows the beautiful structure of the vessel walls better than the other two.

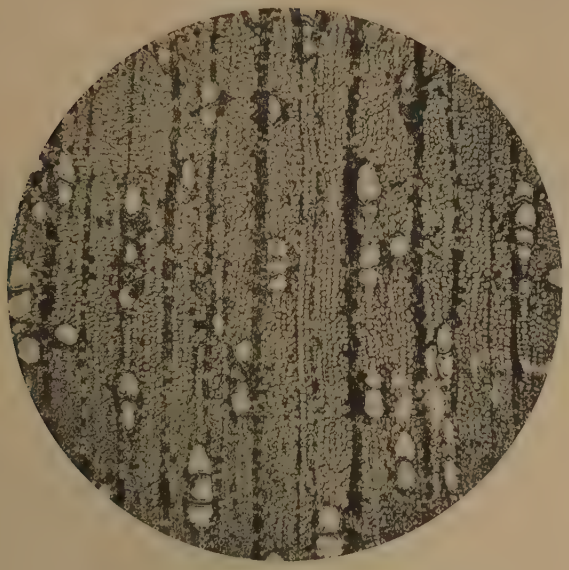
Systematic.

A tree of 60 to 70 feet, perfectly glabrous. Leaves shortly petiolate, ovate-lanceolate, acute or rather obtuse, with much more numerous primary veins than in *B. tomentosa*, 2 to 4 inches long, somewhat glaucous underneath, often drying black. Flowers few together and almost sessile, the floral leaves often deciduous or abortive. Male calyx-segments above 1 line long, thin and spreading. Disk large; staminal column very short, the filaments at least twice as long. Berries black, globular.

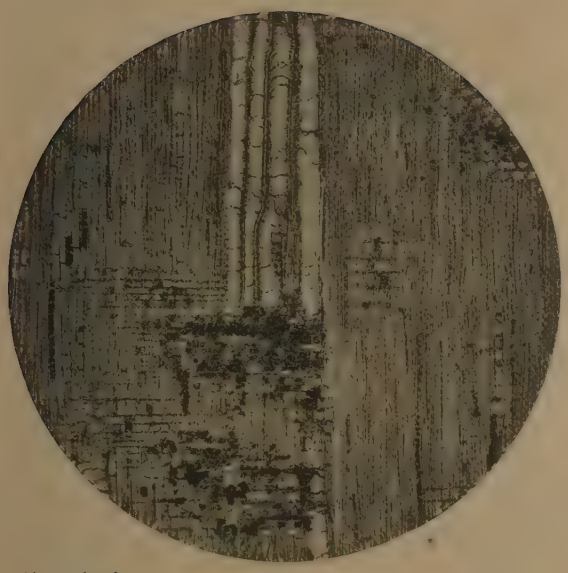
Geographical Range.

Northern parts of the Coastal districts of New South Wales.

FIG. LXXVIII.



CROSS SECTION, showing regular arrangement of fibres; dark lines of rays and small pores.



Micro. photo.]

RADIAL SECTION, showing four vessels in the upper part with tyloses; portions of rays with deposit in some of the cells; and massed fibres with a few wood parenchyma cells.

[*T. C. Roughley.*

TANGENTIAL SECTION.

BRIDELIA EXALTATA, F.v.M.

Croton phebalioides. F.v.M.

"MUSK."

TIMBER.

DESCRIPTION AND USES.

It is moderately hard, close-grained, with a pale, almost white timber, and no prominent figure or sapwood. It is rather of small dimensions, but could be used for various purposes not requiring width, such as chair work.

H. = Moderate. W. = 51 lb. per cubic foot.

Systematic.

A tree attaining 40 to 50 feet, with slender, weak, often pendulous branches, silvery-white as well as the inflorescence and underside of the leaves with a close, scaly tomentum. Leaves petiolate, lanceolate, or the larger ones ovate-lanceolate, and the smaller ones narrow oblong, obtuse, or almost acute, entire or with very small distant teeth, the upper surface green, mostly 1½ to 3 inches long. Racemes 1 to 3 inches long, the flowers usually numerous, mostly males, with here and there a female in the same cluster; in some smaller leaved specimens the flowers few in shorter racemes. Capsule 3 to 4 lines diameter, hirsute with stellate hairs, and often shortly muricate, slightly tridymous.

Geographical Range.

Coastal districts of Queensland, also northern parts of New South Wales.

Croton Verreauxii. Baill.

TIMBER.

DESCRIPTION AND USES.

A timber similar in colour and other characters to *Croton phebalioides*, and difficult to distinguish from that species except in weight. It is softer, but could be used for the same purpose.

H. = Moderate. W. = 39 lb. per cubic foot.

Systematic.

A small tree, either quite glabrous or the smaller branches and foliage sprinkled with a few scattered stellate hairs or scales. Leaves from almost ovate to oblong elliptical or lanceolate, obtuse or acuminate, entire or dentate, rounded or tapering at the base, green on both sides, 2 to 4 inches long in most specimens, but occasionally the larger ones twice that size, the petioles also vary in length. Racemes slender, rarely above 2 inches long. Flowers few in the clusters, the lower ones chiefly female, the upper chiefly or entirely male, on the pedicels of 1 to 2 or rarely 3 lines long, and sometimes the racemes wholly males or chiefly females. Capsule nearly globular, variable in size, sprinkled with stellate hairs or at length glabrous.

Geographical Range.

Northern parts of Queensland and Islands of the Gulf of Carpentaria, also southern coastal districts. Fairly common in many parts of New South Wales.

Dissiliaria baloghioides, F.v.M.

A "TEAK," "RED HEART," "LANCEWOOD." Plate 117.

TIMBER.

DESCRIPTION AND USES.

This is a hard, close-grained, firm timber, of a deep reddish-brown colour, darkening slightly towards the heart. It is somewhat similar in colour, but a shade darker and closer in the grain than our well known Turpentine, *Syncarpia laurifolia*, from which it also differs in weight, being much heavier. The grain is slightly interlocked, giving it a wavy figure on a planed surface. The medullary rays and annual rings are almost invisible on end section. This timber appears to be suitable for railway goods waggons, coachwork, wharf and bridge construction, billiard table legs and heavy cabinet work. Its close texture also gives it promise for bearings.

H. = Hard. W. = 73 lb. per cubic foot.

Systematic.

A glabrous tree. Leaves ovate-oblong or elliptical, entire coriaceous, smooth and shining, 2 to 3 inches long, on a petiole of about ¼ inch. Female flowers three-merous. Fruiting pedicels 2 to 4 lines long, thick, solitary, apparently terminal. Capsule about an inch diameter, minutely tomentose, with a thick corky exocarp separating from the hard endocarp, marked outside with narrow furrows between the cocci and a broad, deep furrow along the line of dehiscence on the back of each coccus. Seeds oval, shining.

Geographical Range.

The East Coast of Queensland and vicinity of Leichhardt and Pine Rivers.

Mallotus claoxyloides, F.v.M.

"ODOUR BUSH."

TIMBER.

DESCRIPTION AND USES.

A pale coloured timber with a yellowish tinge, dark centre; close grained, hard; very much resembles some of the Rutaceæ in general features, and would make a good substitute for English Box.

H. = Moderate. W. = 41½ lb. per cubic foot.

Systematic.

A small or sometimes a handsome tree, the branches and foliage scabrous with scattered stellate hairs. Leaves opposite, but those of each pair often unequal, petiolate, mostly ovate or elliptical and acuminate, but varying from broadly-oblong to almost orbicular, 2 to 6 inches long, obtuse or acute, penninerved and often more or less distinctly three-nerved at the base, green on both sides, with two or more glands near the base, sometimes almost obsolete. Stipules rigidly setiform, short. Flowers diœcious, the males sessile or shortly pedunculate in two or three dense clusters collected in a head or in a short, dense, or scarcely interrupted axillary spike, the females three to six together in an umbel-like cluster on a common peduncle of ½ to 1 inch. Capsule three-didymous, nearly ½ inch diameter, muricate with rigid setiform processes.

Geographical Range.

The Coastal districts of Queensland and the Northern brush forests of New South Wales.

Mallotus Philippinensis. Muell. Arg.

"KAMALA." Plate 118.

TIMBER.

Description and Uses.

A beautiful, pale-coloured, straight-grained timber, not at all unlike some of the best Sapindaceous timbers in facies; not hard in texture. It is rather open in the grain and is inclined to be coarse, with a slight wavy figure. Should be suitable for pale coloured furniture, carriage work, panelling, doors and other interior joinery.

H. = Moderate. W. = 42 lb. per cubic foot.

Anatomical Features.

A distinguishing feature of this timber is that the fibres are arranged in more regular radial rows than obtains in most secondary woods, and the wood parenchyma also follows this arrangement in some instances, but otherwise it occurs irregularly scattered throughout the other wood elements and occasionally contains a brownish substance in the cells. The walls of the fibre are of medium thickness and have very fair-sized perforations. The vessels belonging to the narrow variety, the cells being mostly free of tyloses, but the walls of these contiguous elements are interesting. The rays are numerous, of one to three cells in width, these being narrow and elongated and marked top and bottom by tracheid cells.

Systematic.

A tree often acquiring a considerable size, the branches and inflorescence more or less ferruginous-tomentose. Leaves on long petioles, oblong, ovate-lanceolate or almost ovate, acuminate or obtuse, entire, contracted or rounded and three-nerved at the base, 3 to 6 inches long, more coriaceous than in the preceding species, the upper side glabrous, with obscure glands near the base, the under surface pale or ferruginous, with a minute tomentum, the principal veins ferruginous-tomentose. Flowers dioecious, the racemes terminal or in the upper axils, the males more branched than the females, all much shorter than the leaves. Male perianth segments membranous, about 1 line long. Female perianth ovoid tubular, four or five toothed, enclosing the ovary. Styles short, oblong, densely fringed on the inner face. Capsule tridymous, 3 to 4 lines diameter, covered with a red stellate tomentum without any process. Seeds nearly globular.

Geographical Range.

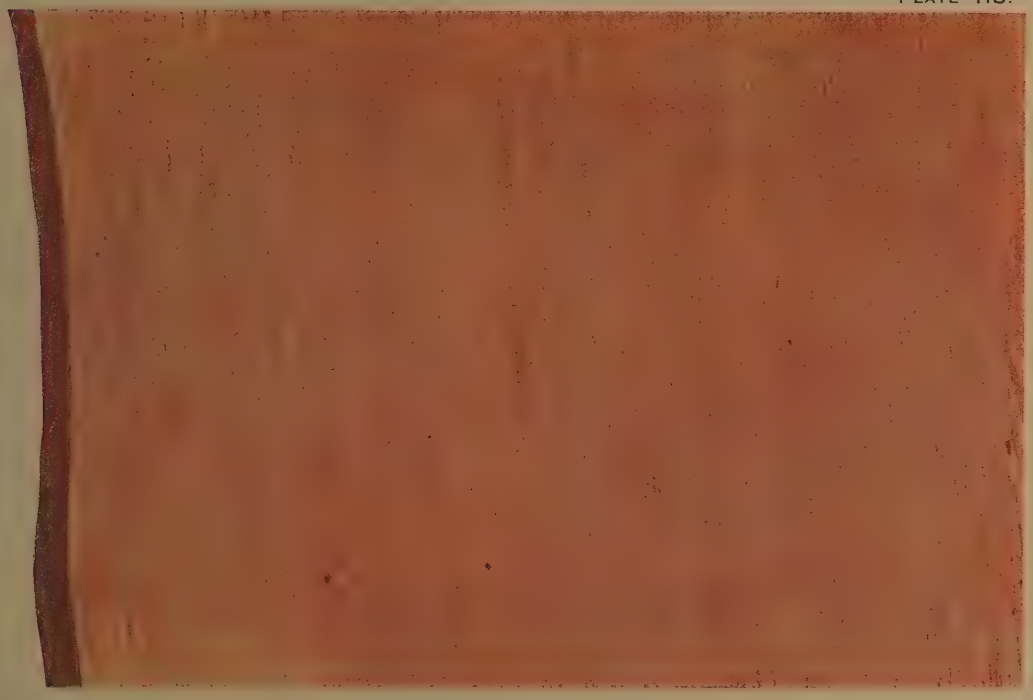
East Coast district of Queensland and New South Wales.

PLATE 117.

RED HEART.

(*Dissilaria Baloghioides*, F.v.M.)

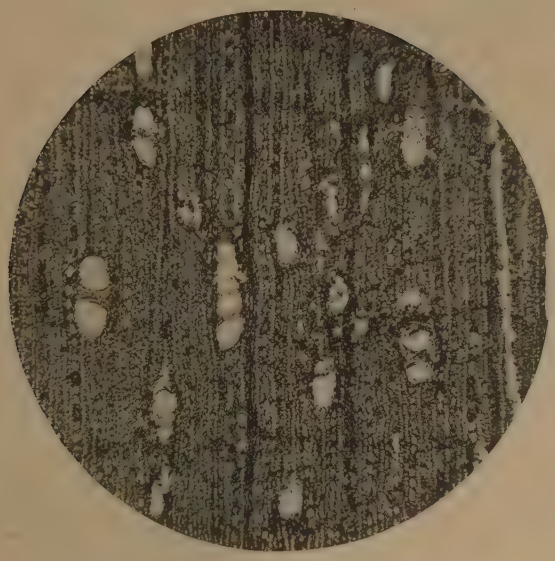
PLATE 118.



KAMALA.

(*Mallotus Philippinensis*, MUELL. ARG.)

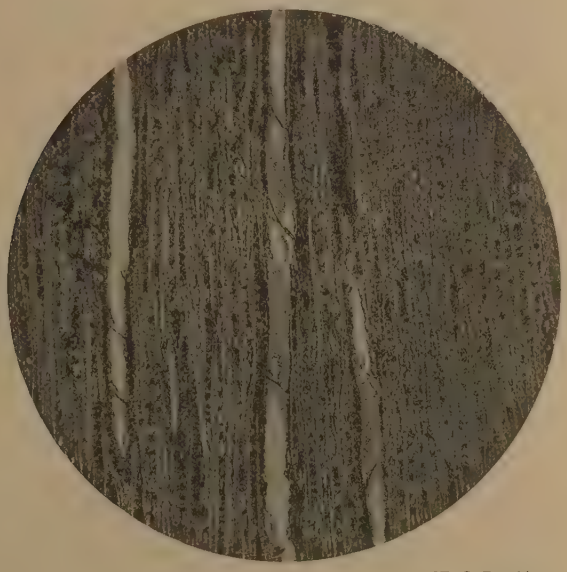
FIG. LXXIX.



CROSS SECTION, showing unusual appearance of the two forms of cells of ray parenchyma seen in radial rows parallel to the fibres, in the one towards the extreme left, calcium oxalate crystals can be seen. Pores are few in this species.

Micro photo.]

RADIAL SECTION, showing heterogeneous rays, in the outer cells of which are in a few cases two, three, or four crystals. Some are also seen at the top in wood parenchyma cells.



[*T. C. Roughley*

TANGENTIAL SECTION, the vessels (centre and right) showing wall pits. On the right are crystals in wood parenchyma.

MALLOTUS PHILIPPINENSIS, MUELL. ARG.

Mallotus discolor, F.v.M.

"YELLOW KAMALA TREE."

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey, Q. Fl., Vol. V, p. 1449, describes this timber as light yellow in colour, close grained, and tough.

Systematic.

A tall tree, the branches, inflorescence and underside of the leaves white, with a short, close tomentum, with more or less of longer hairs on the principal veins underneath. Leaves on rather long petioles, ovate or ovate-lanceolate, acute or acuminate, thinner and smoother than in *M. repandus*, 2 to 3 inches long, becoming quite glabrous on the upper side, rounded or acute and three-nerved at the base, not at all peltate, the flat glands rather prominent, the small glands of the under surface very numerous as in the three preceding species. Male racemes slender, simple, 3 to 4 inches long, in the lower axils of the young shoots as in *M. rapandus*. Flowers smaller than in that species, very shortly pedicellate. Stamens numerous, the anther-cells attached to a small connective. Female flowers and fruits unknown.

Geographical Range.

Coastal districts of Queensland.

Baloghia lucida, Endl.

"BRUSH BLOODWOOD." Plate 119.

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey states, Q. Fl., Vol. V, p. 1459, that this timber "is pale yellow in colour," almost changing to white, medium close grained, tough and slightly interlocked, and small radial figure. It is a timber that needs careful seasoning, otherwise it will stain. It grows to a large tree, and timber of good width is obtainable. For building purposes, carriage and coach parts it should be acceptable, and perhaps could be used for certain portions of shipwrights' work.

H. = Moderate. W. = 48 lb. per cubic foot.

Systematic.

A large tree, the trunk with the bark often much knotted and much stained by the flow of red sap. Leaves opposite, very shortly petiolate, oblong obovate-oblong or elliptical, obtuse or obtusely acuminate, rigidly coriaceous, glabrous and shining, the primary veins numerous, fine but prominent, transverse and anastomosing. Flowers white, fragrant, few together in short, loose, sessile terminal racemes, the males and females usually on separate branches, but sometimes the lower one or two pairs female and the upper two or three pairs male; the pedicels opposite, $\frac{1}{4}$ to $\frac{1}{3}$ inch long, solitary in the axils of very small bracts. Capsule echinate, hard, globular, $\frac{1}{2}$ to $\frac{3}{4}$ inch diameter, somewhat tridymous, with a furrow bordered by two narrow ridges on the back of each coccus.

Geographical Range.

East Coast districts of New South Wales and Queensland.

PLATE 119.

BRUSH BLOODWOOD.
(*Baloghia lucida*, ENDL.)

PLATE 120.

NATIVE ELM.
(*Aphananthe Philippinensis*, PLANCH.)

Excæcaria Dallachyana, Bail.

"SCRUB POISON TREE."

TIMBER.

DESCRIPTION AND USES.

A pale-coloured timber, almost white, open but straight grained. It has no prominent figure or sapwood, is firm, and a splendid working timber, seasons well, and is fairly heavy. Should be a suitable timber for house building, doors, frames, flooring, cabinet work not requiring figure, coach body parts, carving and turning.

H. = Moderate. W. = 53 lb. per cubic foot.

Systematic.

Nearly allied to *E. Agallocha*, and perhaps really only an inland variety. Leaves ovate-lanceolate or ovate, obtusely acuminate, crenate, 1 to 3 inches long, less coriaceous and the veins more prominent and reticulate underneath. Flowers both male and female apparently the same as in *E. Agallocha*.

Geographical Range.

Inland districts of Queensland.

NATURAL ORDER.

Urticeæ.

One of the most widely distributed Natural Orders in the botanical world, but few species are famous for their timber; however, one or two Australian representatives come in the category of hardwoods.

Species Illustrated in Colour:—

Aphananthe Philippinensis, Planch. (Native Elm).

Celtis paniculata, Planch.

"INVESTIGATOR TREE."

TIMBER.

Description and Uses

This species attains brush tree proportions, and has a pale-coloured, almost white, hardwood, but is not recommended as it is very subject to the attack of borers.

H. = Hard. W. = 44 lb. per cubic foot.

Geographical Range.

Coastal districts of Queensland and New South Wales.

Aphananthe Philippinensis, Planch.

"NATIVE ELM" or "AUSTRALIAN HICKORY." Plate 120.

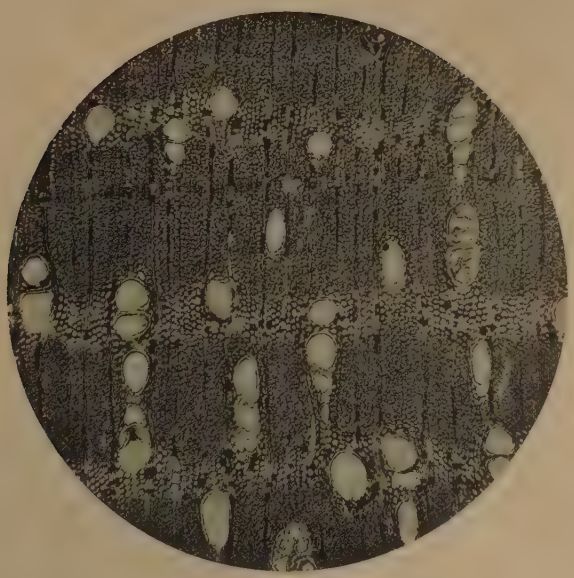
TIMBER.

Description and Uses.

A pale grey, almost white timber, with a straight, fairly close grain. On end section the medullary rays are invisible and the annual rings are very compact. It is of a tough, hickory nature to work, and should be a good substitute for that timber for tool handles of every description. The timber should also be well adapted for cabinet making, panelling, interior joinery, coach and carriage work, and ship building.

H. = Moderate. W. = 46 lb. per cubic foot.

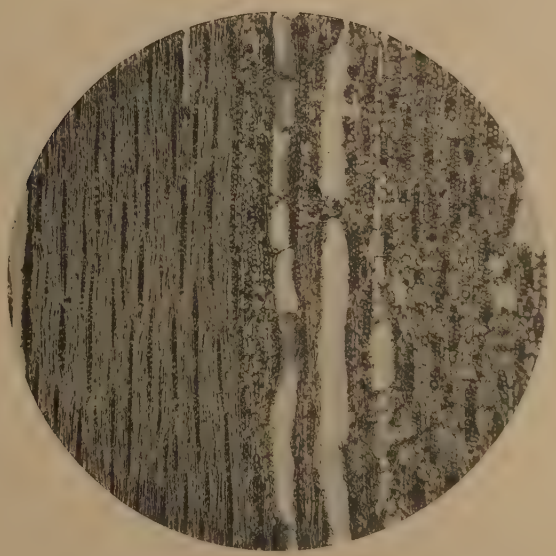
FIG. LXXX.



CROSS SECTION, showing alternate bands of fibres and wood parenchyma, thick-walled pores, and rays.

Micro. photo.]

RADIAL SECTION, showing fine, heterogeneous rays and two bands of wood parenchyma and portions of three vessels.



[*T. C. Roughley*

TANGENTIAL SECTION, left half through fibres and rays and right half through parenchyma, vessels, and rays.

APHANANTHE PHILIPPINENSIS. PLANCH.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	8,260	7,660	7,670
Modulus of rupture in lb. per square inch ...	15,879	14,437	11,408
,, elasticity ,, ,, ...	1,900,486	1,956,403	1,621,115
Rate of load in lb. per minute	550	548	512

ANATOMICAL FEATURES.

In a transverse section, except for thickness of the rays, this timber somewhat resembles that of the Grevilleas. The fibres with their thick walls and few wall perforations are arranged in alternate rings of wood parenchyma or tracheids—the lumen being small. The pores are fairly numerous, but mostly two or three connate, in which case the partition walls show a serration to each other; the wood parenchyma seems quite limited, its place being taken by what appears to be an unusually large system of tracheids, and this seems to predominate with the rays which are mostly of the multiseriate variety. In most of the vessels occur tyloses, and in a few of the ray cells are to be found a brown secretion. The tangential section is a particularly interesting one amongst three secondary wood sections of the species.

Systematic.

A tree, glabrous or scalous—pubescent. Leaves shortly petiolate, broadly ovate to elliptical, acute or almost obtuse, rigidly membranous or coriaceous, scabrous, the primary veins very prominent underneath, and although anastomosing near the margin generally produced into small rigid mucronate teeth; the whole leaf usually 1 to 2 inches long or larger, ovate-lanceolate, truncate or almost cordate at the base, the marginal teeth more prominent; on other specimens the leaves smaller, broader, and deeply divided into pungent-pointed lobes. Male cymes almost sessile, but loose. Perianth segments broad, concave, ciliolate. Female perianth segments narrower. Fruit ovoid, acuminate, about 3 lines long.

Geographical Range.

The Coast districts of Queensland and the North Coast of New South Wales.

Pseudomorus Brunoniana, Benth.

"WHALEBONE TREE."

TIMBER.

DESCRIPTION AND USES.

A pale yellow coloured timber, with a close, straight grain and no prominent figure. The medullary rays are very fine and numerous. It is a splendid firm-working timber, and should be suitable for turning, chisel handles, cabinet and interior joinery work.

H. = Moderate. W. = 48 lb. per cubic foot.

Systematic.

A small tree, attaining sometimes 30 to 40 feet; glabrous or nearly so. Leaves very shortly petiolate, elliptical, ovate-lanceolate or lanceolate, mostly acuminate, denticulate, 1½ to 4 inches long, penniveined, often slightly pubescent on the underside, especially on the nerves, and sometimes scabrous above. Spikes solitary in the axils, sessile or shortly pedunculate, the males not above 1 inch long in the majority of the Australian specimens, but in a few of these and especially in the Norfolk Island variety, lengthening to 2 or even 3 inches. Perianth segments about ½ line long. Female spikes very small, usually containing only three or four flowers, each within a minute bract. Berries globular, the size of a currant or sometimes rather larger.

Geographical Range.

The Coastal districts of Queensland and the whole Coastal districts of New South Wales.

NATURAL ORDER.

Casuarineæ.

THIS is one of the most remarkable Natural Order of plants in the vegetable kingdom and contains only one genus, which is practically Australian in its distribution, only one species, *C. equisetifolia*, extending outside Australia.

All the woods are hard and heavy, and are famous, with one exception, *C. Cambagei*, for their exceptionally large rays, in which respect they show greatest affinity to the Proteaceæ timbers.

The "Oak" figure of these woods is so well marked that in Australia they, with one exception, are called "Oaks," being designated under such names as Swamp Oak, Bull Oak, Forest Oak, River Oak, Mountain Oak, &c. The one exception is "Belah" (*Casuarina Cambagei*), and, strange to relate, the absence of any figure, or, for the matter of that, any resemblance to the wood of its congeners, is so marked, that the man on the land refuses to acknowledge its claims to rank as an "Oak." These trees are plentiful in certain parts of the States, so that if the trade could be prevailed upon to start a fashion in our "Oaks," Australians would have another furniture timber that would compare with the ornamental timbers of other countries. The wood, however, is heavier than English Oak. The Belah wood more nearly approaches Walnut in colour and texture, but is rather heavier. It has not, however, the figure of a commercial Walnut. A general common name for the species is "Shee Oaks," on account of the peculiar sound produced by the wind when passing through the branches.

SPECIES ILLUSTRATED IN COLOUR :—

Casuarina glauca, Miq. (Swamp Oak).

C. Luehmanni, R.T.B. (Bull Oak).

C. Cambagei, R.T.B. (Belah).

C. torulosa, Ait. (Forest Oak).

C. Cunninghamiana, Miq. (River Oak).

Casuarina stricta, Ait.

"MOUNTAIN OAK."

TIMBER.

DESCRIPTION AND USES.

A hard, reddish-brown coloured timber with the usual radial or silver grain figure of the Order. It is similar in character to *Casuarina torulosa*, Forest Oak, and could be used for small ornamental articles in the trade.

H. = Very Hard. W. = 62½ lb. per cubic foot.

Systematic.

A medium tree with the branchlets usually if not always pendulous; notwithstanding the name, the branches are more robust than in *C. equisetifolia*, the whorls of nine to twelve parts, the internodes often ½ inch long or more, the ribs rather prominent, the sheath-teeth acute or shortly acuminate. Flowers dioecious. Male spikes, some of them terminating; deciduous branchlets.

Geographical Range.

Interior of all the Eastern States.

Casuarina glauca, Sieb.

"SWAMP OAK." Plate 121.

TIMBER.

DESCRIPTION AND USES.

A very hard, close-grained timber, with a pale outer portion and a darker (light brown) inner part.

The rays are very conspicuous whichever way the timber is cut, but, of course, more particularly on the quarter.

It could be used for heavy work of all kinds, such as carriages and waggons, and bullock yokes. It is especially beautiful in curtain poles, balusters, newel posts, and heavy cabinet work.

As the common name implies, this tree, which attains a fair height, with a corresponding diameter, occurs in the river swamps of the coast, and does not extend far inland. The flitches have limited dimensions, but nevertheless of sufficient sizes to be utilised in many ways in cabinet work, either in the solid or veneers. It is a particularly hard close grained wood; the medullary rays being well pronounced give a "flower" when cut on the quarter; but what gives an additional value to the figure is the dark, almost black, duramen, which is peculiar to this species amongst "Shee Oaks." It takes a good polish, but is rather difficult to dress by hand, a slight defect which does not obtain when

machine prepared. It should make in the solid, beautiful hall stools, benches, tables and dining chairs; and, in veneers, many are the directions in which it could be used, as well as for coachbuilding in various ways. Such a wood certainly deserves more appreciation in the directions here particularised than has been bestowed upon it in the past, but at present is only used for firewood.

H. = Hard. W. = 56 lb. per cubic foot.

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	7,720	9,330	8,700
Modulus of rupture in lb. per square inch ...	15,440	18,660	17,400
,, elasticity ,, ,, ...	1,846,100	2,181,800	2,181,800
Rate of load in lb. per minute	1,102	1,166	1,087

Systematic.

A tree, attaining often a considerable size, the specimens sometimes very difficult to distinguish from those of *C. stricta*, the internodes, however, much less prominently ribbed and becoming glaucous in open dry situations. Whorls usually ten to twelve-merous, but the parts varying from nine to sixteen, the sheath-teeth short on the deciduous branchlets, more acuminate on the permanent branches. Male spikes rather dense, ½ to 1 inch long, the sheath-teeth sometimes ciliate with points. Cones usually sub-globose, flat-topped, rarely much above ½ inch diameter, the valves very prominent, often pubescent on the back, thickened into a smooth dorsal prominent angle or keel.

Geographical Range.

Coastal districts of Queensland, New South Wales, Victoria and South Australia.

Casuarina equisetifolia, Forst.

TIMBER.

DESCRIPTION AND USES.

F. M. Bailey states, Q. Fl., Vol. V, p. 1490, that this timber is of a dark colour, coarse grained, but nicely marked.

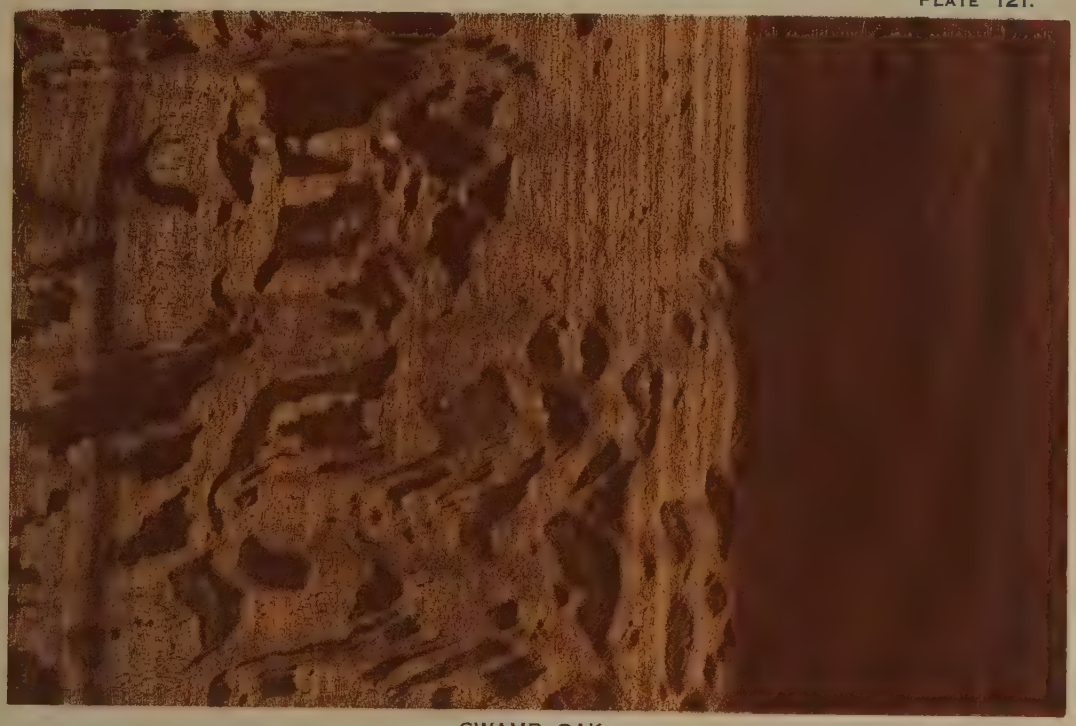
Systematic.

A tree attaining a large size, but so frequently cut that it is generally met with much smaller, principal branches elongated and spreading or ascending, the smaller ones often pendulous, glabrous, or tomentose when young. Whorls usually seven-merous, but the parts varying from six to eight. Sheath-teeth short and acute or sometimes fine-pointed on the persistent branches, the internodes rarely exceeding ½ inch, the ribs rather prominent. Flowers dioecious, male spikes about ½ inch long, terminating slender deciduous branchlets, the sheaths of the spikes closely imbricate. Fruit cones very shortly pedunculate on the persistent branches, globular, usually about ½ inch diameter, the valves protruding about 1 line, broadly ovate, obtuse, pubescent outside, without any or with a very obscure dorsal protuberance at the base.

Geographical Range.

Fairly common throughout the Northern Coast of Queensland, also the Islands of the Gulf of Carpentaria.

PLATE 121.



SWAMP OAK.

(*Casuarina glauca*, SIEB.)

PLATE 122.

RIVER OAK.

(*Casuarina Cunninghamiana* MIQ.)

Casuarina suberosa. Ott. et Dietr.

"FOREST OAK."

TIMBER.

DESCRIPTION AND USES.

A chocolate or brownish coloured timber, and of equal excellence for the purposes enumerated under *C. glauca*, but has the least pleasing colour of all the Casuarinas.

H. = Hard. W. = 57½ lb. per cubic foot.

Systematic.

A tree of 30 to 40 feet, the specimens closely resembling those of *C. equisetifolia*, the whorls similarly seven-merous or the parts varying from six to eight, and often monœcious like that species. Branches seldom if ever corky, the branchlets usually slender and quite glabrous. Male spikes much more slender and interrupted, the short sheaths not overlapping those next above. Fruit cones more frequently tending to become ovoid or oblong, truncate at both ends, the valves more prominent, glabrous or nearly so, with usually a short, thick, but almost scale-like transverse dorsal protuberance at the base, rarely extending nearly to the apex of the valve.

Geographical Range.

Mountain ranges and Coastal districts of New South Wales, Queensland and Victoria.

Casuarina Cunninghamiana. Miq.

"RIVER OAK." Plate 122.

TIMBER.

DESCRIPTION AND USES.

This is the palest coloured of all the Casuarinas, and so is easy of determination from its congeners. It requires careful seasoning, but is a beautifully figured wood and suitable for all the purposes mentioned under *C. glauca*. The rays are particularly large.

Amongst Australian "Shee" Oaks this species ranks as the largest, and some fine, noble specimens are to be found on the banks of fresh-water streams included in its range. The timber rarely reaches the Sydney markets, as the trees are scarcely ever cut down, being regarded perhaps as a necessary adjunct to the river scape. The wood takes a good polish, having a close, hard texture. The heartwood is pale chocolate in colour, and outer portion almost white. The figure is well brought out on the quarter, and looks elegant in panelling, drapery poles, rods, &c., and it should make up well in heavy furniture, and in carving, although, of course, it is hard—but so is English Oak, which is perhaps

more carved than any other timber. It is very strong and durable, and for this reason it is utilised for bullock yokes in some districts. The two distinctive colours would give it a unique appearance in turnery, such as serviette rings, cornice pole rings, &c.

H. = Hard. W. = 48 lb. per cubic foot.

TRANSVERSE TEST OF TIMBER.

(The following was made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

Breaking load in lb.	7,200
Modulus of rupture in lb. per square inch ...	14,400
,, elasticity ,, ,, ...	1,674,400
Rate of load in lb. per minute	1,028

Systematic.

A tree, one of the largest of the genus, with slender branches, closely resembling *C. equisetifolia* and *C. suberosa* in the aspect of the specimens and number of parts of the whorls, and possibly a variety of the one or the other, but the fruiting cones are much smaller, scarcely exceeding 4 lines in diameter in any of the specimens seen, globular, very regular, glabrous, with prominent valves. Male spikes slender, like those of *C. suberosa*, but more dense.

Geographical Range.

River banks in the Coastal ranges and Central districts of New South Wales and Queensland.

Casuarina Fraseriana. Miq.

A "SHEE OAK."

TIMBER.

DESCRIPTION AND USES.

This timber is a warm, reddish colour, medium weight, with a very nice oak grain when cut on the quarter. Suitable for ordinary cabinet making purposes; should make up well into chairs, table legs, balusters, or any purpose requiring an ornamental character; fairly tough and strong.

H. = Moderate. W. = 42 lb. per cubic foot.

Systematic.

A tall erect dioecious shrub or small tree, nearly allied to *C. distyla*, and very difficult to distinguish from it without the cones. These are in the typical form nearly globular, ¼ inch diameter, very woody, the valves shortly prominent, the dorsal protuberances very rugose though not divided regularly into distinct tubercles, in another specimen they are more nearly of the shape of those of *C. distyla*, but 1 inch long or more, and again some detached cones in the Kew Museum are more like the typical ones but larger, with more numerous parts to the whorl.

Geographical Range.

Western Australia.

C. lepidophloia, F.v.M.

THE original description and specimens of this species are not sufficiently definite to say what tree is meant, so the timber cannot be identified.

Casuarina torulosa, Ait.

"FOREST OAK." Plate 123.

TIMBER.

DESCRIPTION AND USES.

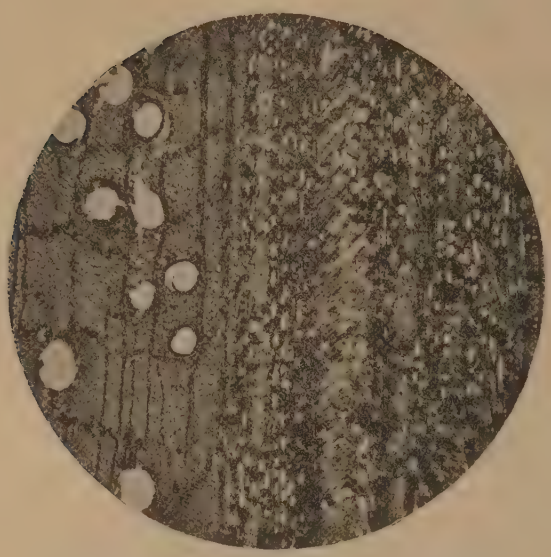
The reddest-coloured of all the species of the genus, and so can be readily recognised amongst other timbers. It would make the most beautiful of hardwood cabinet work, but can be utilised for similar economic purposes mentioned under other species.

Forest Oak split shingles were at one time extensively used in this country, specimens taken from roofs 60 to 70 years old are exhibited in this museum and show a good state of preservation. The present price on the Sydney market, 65s. per 1,000, practically prohibits their use in this direction.

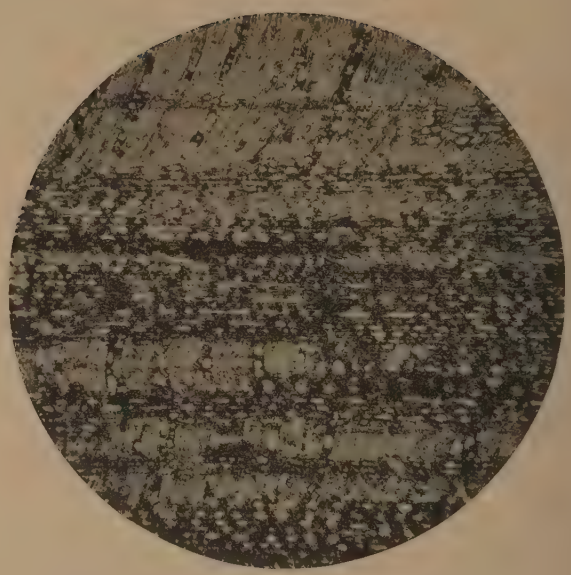
This tree, from its native habitat, is not difficult of identification in the field, for the fruits, or cones as they are sometimes called, when once seen, can easily be differentiated from those of its congeners; the valves are less prominent than in other species, the intervening ligneous substance being strongly rugose. The timber is also distinct, having a uniform warm red colour throughout. The rays are well marked, producing the usual "Oak" figure of the genus. It is hard, strong, close grained, yet fissile, polishes into a warm rich colour, and could be utilised in many ways in fancy cabinet work, but not in large slabs, as the tree at its full size averages 50 feet high and 18 inches in diameter. Like the rest of the species, it requires to be sawn methodically as soon as felled, and stacked for seasoning, for if not it splits in a very uneven manner, and so much timber is wasted. It is very suitable for balusters or any kind of small turnery, being very strong; also for yokes, heavy waggon work, walking sticks and rulers.

H. = Very Hard. W. = 67 lb. per cubic foot.

FIG. LXXXI



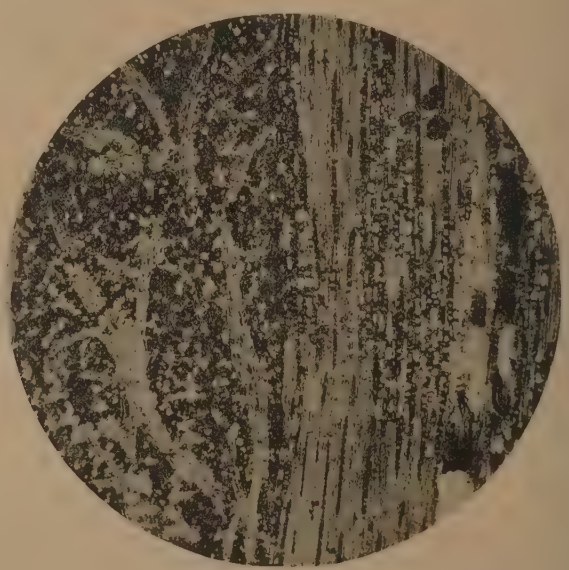
CROSS SECTION, showing arrangement of fibres on the left half, with pores and single rays, and about six irregular rows of wood parenchyma; on the right is seen a section through a very large ray.



RADIAL SECTION through a large single ray, showing at the top fibres cut in the long axis and giving a wavy appearance to the grain.

Micro. photo.]

RADIAL SECTION, showing small rays and two vessels with cell content.



[*T. C. Roughley.*

TANGENTIAL SECTION, showing large ray in left half of the plate, with fibres and wood parenchyma towards the right of centre.

CASUARINA TORULOSA, AIT.

PLATE 123.

FOREST OAK.

(*Casuarina torulosa*, Ait.)

PLATE 124.

BELAH.

(*Casuarina Cambagei*, R.T.B..)

TRANSVERSE TESTS OF TIMBER.

(The following were made upon selected timber of standard size 38 in. x 3 in. x 3 in.)

	No. 1.	No. 2.	No. 3.
Breaking load in lb.	8,570	8,370	8,700
Modulus of rupture in lb. per square inch ..	17,140	16,966	17,400
,, elasticity ,, ,, .	2,117,600	2,085,800	2,057,100
Rate of load in lb. per minute	1,071	1,195	1,087

Systematic.

A small tree, dicœcious, or sometimes moncœcious, with more slender branchlets than any other species except some forms of *C. suberosa*, the ribs scarcely prominent. Whorls four-merous, the sheath very short. Male spikes very slender, ½ to 1 inch long, terminating deciduous branchlets, compact, although the short sheaths scarcely overlap. Cones nearly globular, but flat-topped, about ¾ inch diameter, the valves very woody, broad, slightly protruding, villous on the dorsal protuberance, divided into numerous small, nearly equal tubercles.

Geographical Range.

Coastal ranges and districts of New South Wales and Queensland.

Casuarina Cambagei, R.T.B

"BELAH." Plate 124.

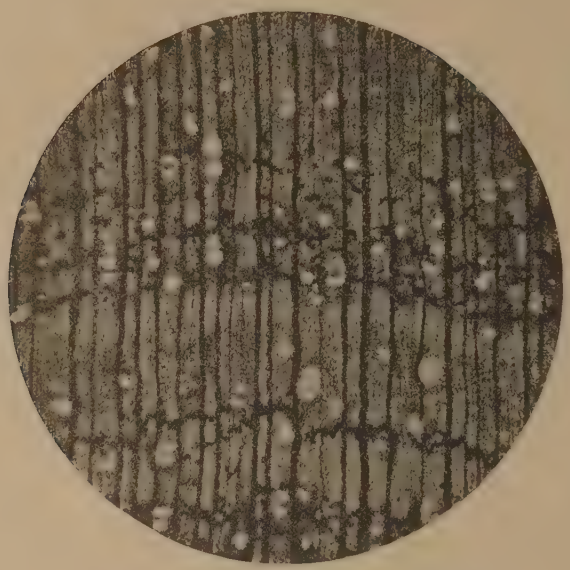
TIMBER.

Description and Uses.

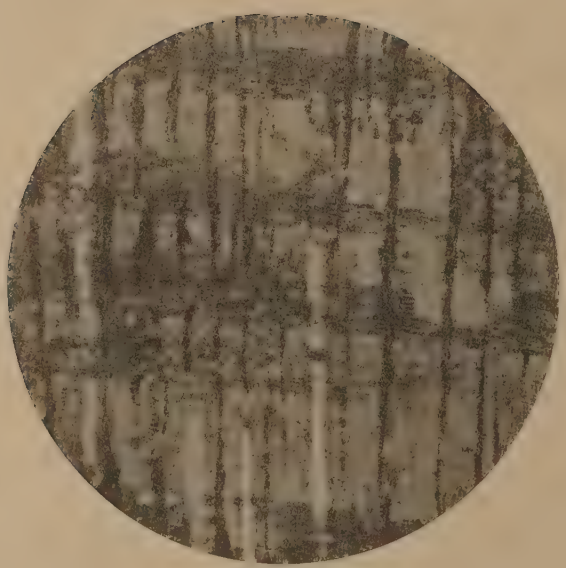
It is now a well-known tree of the interior, and is differentiated without much difficulty from its family—"Oaks," both in the field and herbarium, but more especially in a ligneous classification, for the timber is quite characteristic and has no resemblance to that of any of the other Casuarinas. The common name, Oak, has been applied to all the Australian Casuarinas except this one, a fact probably due to the nature of the timber, which is quite devoid of the *Quercus* feature of all the other woods of the genus. It is very dark chocolate in colour, hard, close grained, without a figure, and, but for this latter defect, might be classed as a "Walnut" timber. It dresses to a hard, firm, even surface, takes a good polish, and could be used for several forms of cabinet work where solidity is a *sine qua non*. It could be used for any purpose where weight and hardness in timber are requisite, and is the most suitable of all Australian timbers for shaft bearings, being the nearest substitute for *Lignum vitæ* so extensively used for this purpose.

The illustration is given in connection with this species to show the contrast between it and other Casuarina timbers. As will be seen,

FIG. LXXXII.



CROSS SECTION, showing very fine texture of the wood, the fibres being of exceedingly small diameter. The wood parenchyma is scattered or in broken lines bounding the late wood; numerous regular rays are also shown.



Micro. photo.]

RADIAL SECTION, showing how indistinct are the rays even in a microscopical section.

[*T. C. Roughley.*

TANGENTIAL SECTION. The three vessels are plugged with tyloses; and the rays are quite insignificant compared with those of its congeners.

CASUARINA CAMBAGEI, R.T.B.

there is nothing macroscopically to associate it with the timbers of other Casuarinas, the medullary rays being too fine to be seen; the colour is also quite exceptional; in fact, as shown by me before our local Linnean Society in 1911, it may be regarded as the anomalous species of the genus. At a casual glance it might easily be mistaken for a Myall or Brigalow, from its colour and texture, although it has no aroma such as obtains in their case.

H. = Very Hard. W. = 72 lb. per cubic foot.

ANATOMICAL FEATURES.

Macroscopically this timber is very distinct from its congeners, but microscopically it differs very little in structure from them. The main difference is the size of the rays, being nearly all uniseriate, the large multiseriate form of the others being quite absent. All the wood elements are identical in structure, &c., with those of other Casuarinas, a brown deposit occurring much more frequently in this species and the vessels being almost closed with tyloses.

Casuarina timbers, except for the large pronounced rays, are otherwise identical with some Eucalyptus woods in structure, even to the deposition and colour of the deposit found in the wood elements.

Systematic.

A tree attaining a height of from 70 to 100 feet, dicœcious, glabrous; branchlets glaucose or dark green in the slender form, ascending internodes varying in length up to half an inch, not prominently angled. Whorls nine to ten-merous, the sheath-teeth acute. Male spikes at the ends of the branchlets, in the slender variety from 1 to 12 inches long, in the glaucous variety usually 1 inch long, sheathing teeth erect. Cones cylindrical, about 12 to 14 inches long, and 10 to 12 inches broad, truncate, valves obtuse, very prominent, glabrous or minutely hoary, pubescent on the exposed dorsal prominence or thickening. Nuts pale coloured, 3 lines long, including samara.

Geographical Range.

Interior of South Australia, New South Wales and Queensland.

Casuarina Luehmanni, R.T.B.

"BULL OAK." Plates 125-6.

TIMBER.

DESCRIPTION AND USES.

For pride of figure the "Bull Oak" surpasses all its congeners; the medullary rays are more strongly developed than in that of any other species of Casuarina, or perhaps any other Australian tree. They are a very marked feature of the timber when cut on the quarter, some of them measuring an eighth of an inch in thickness and over an inch

in height. These rays also possess some property that enables them to resist weathering long after the other parts of the wood have decayed—a fact noted by Mr. R. H. Cambage in his field experience. It looks beautiful when polished, having a full oak character ; is a hard, heavy timber, close grained, and only requires an original mind in the trade to turn it to good account, for it could be made useful in very many directions in cabinet work. Could be also used for heavy waggon parts.

H. = Very hard. W. = 74½ lb. per cubic foot.

Systematic.

A fair-sized tree, attaining a height of 70 to 80 feet, or rarely 100 feet, and a diameter of from 1 to 1½ feet, rarely 2 feet. Bark furrowed, brittle, and easily removed. Branchlets robust, light-coloured or glaucous, under 1 line (⅛) in diameter, about the same thickness as in *C. glauca*; the internodes ribbed 6 lines long, glaucous, the nodes yellow, sheath teeth brown or black, short, acute, nine to twelve on the whorl, mostly eleven. Flowers diœcious. Male spikes about 1 inch long, of a light golden-brown colour, clustered at the nodes toward the end of the branchlets; internodes straw-coloured, teeth golden coloured, erect, short, acuminate, constricted at the nodes. Fruit cones flattened, about ½ inch in diameter, and consisting almost uniformly of three disks or rows of valves, but often irregularly shaped, owing apparently to only a few of the seeds being developed. Valves protruding, prominent, sometimes pubescent at the back and front, with a well-defined dorsal protuberance extending from the base of the valve to half its length, and ending in an abrupt angle, broadly obtuse or shortly acuminate. Nuts small, dark brown, shining, with a short samara.

Geographical Range.

Interior districts of Queensland and New South Wales.

Casuarina inophloia, F.v.M. et Bail.

"STRINGYBARK OAK."

TIMBER.

DESCRIPTION AND USES.

A hard, close-grained, reddish-coloured timber, with the usual handsome Casuarina figure. This wood could be used for all ornamental turnery, small cabinet work and silversmiths' art. Care should be taken not to utilise any of the white sapwood as it is prone to borers.

H. = Very hard. W. = 66 lb. per cubic foot.

Systematic.

A small tree with a loose fibrous bark, whorls seven to nine-merous, the sheath-teeth acute. Male and female inflorescence resembling that of *C. suberosa* having the same long slender male spikes and rich purplish-red, female heads. Cones, 9 to 11 lines long, 7 to 8 lines broad, on peduncles of about 6 lines, almost globular, depressed at the top, axis densely beset with straight pale-brown hairs.

Geographical Range.

Generally met with on sandy poor spots in the southern parts of the colony.

PLATE 125.

BULL OAK.

(*Casuarina Leuhmanni*, R.T.B.)

PLATE 126.

BULL OAK.

(*Casuarina Leuhmanni*, R.T.B.)

NATURAL ORDER.

Cupuliferæ.

THE trees of this Natural Order are famous the world over for their valuable timbers, which are more commonly known as Oaks, Hornbeams, and Beeches. The two former do not occur here, those known locally as " Oaks " belong to quite a different Natural Order, viz. :—The Casuarineæ. There are, however, three true Beeches here, but only one may be regarded as hard, and that only moderately so, viz. :—*Fagus Moorei*, Negro Head Beech of New South Wales.

Fagus Moorei, F.v.M.

"NEGRO HEAD BEECH."

TIMBER.

DESCRIPTION AND USES.

This timber has quite a different facies from the European Beech, the colour and nature of that wood being wanting in this Australian Beech.

It is a fairly hard, straight, rather close-grained timber of a reddish brown colour. The rays are almost invisible, and the annual rings very close. It is a splendid cutting timber and should be very acceptable for carving or engraving. When thoroughly seasoned it could be used for cabinet work, joinery, turning, and coach and carriage body parts.

H. = Moderate. W. = 62 lb. per cubic foot.

Systematic.

A beautiful tree, 150 feet high, the trunk of some of them 70 feet to the branches, closely allied to *F. Cunninghamii*, but at once known by the leaves, which are 1 to 2 inches long on the barren shoots, ¾ to 1 inch on the following branches, ovate or ovate-lanceolate, acute or a few only of the lowest obtuse, flat, and coriaceous, as in *F. Cunninghamii*, but with more numerous and rather more prominent primary veins. Flowers unknown. Fruits of *F. Cunninghamii*, but larger, the involucres mostly about 5 lines long.

Geographical Range.

The high mountain slopes of the North Coast district of New South Wales.

NATURAL ORDER.

Santaliacæ.

A FAIRLY well distributed Order over the world, and famous more particularly as yielding the Sandalwood of the East. There are one or two species in Australia that call for remark in this work, and one produces the Sandalwood of Western Australia, although the tree occurs throughout several of the States, but is only exported from the West. Most of the other representatives of the Order in Australia are small shrubs, but there is one exception that might be mentioned, namely, the Native Cherry (*Exocarpus cupressiformis*). The figure of this wood is small, but pretty, and looks well when used to aid decoration in cabinet work.

Fusanus acuminatus, R.Br.

"QUANDONG."

TIMBER.

DESCRIPTION AND USES.

A pale coloured, almost white timber, with a fine interlocked, medium close grain. The medullary rays are very small, and the width of the annual rings point to the appearance of a fast growing tree. It is rather tough to work, but should be suitable for various purposes in the joinery or cabinet trade.

H. = Moderate. W. = 41½ lb. per cubic foot.

Systematic.

A tree of 20 to 30 feet. Leaves opposite, lanceolate, acute or sometimes, when young, with a short hooked point, mostly 2 or 3 inches long and tapering into a petiole of 2 or 3 lines, but very variable in size and breadth, coriaceous, with the lateral veins often prominent when old. Flowers rather numerous in a terminal pyramidal panicle scarcely longer than the leaves, but in some of the western specimens much reduced. Perianth spreading to about 2½ lines diameter. Free margin of the disk very prominent, broadly rounded between the stamens which curve over the notches. Fruit globular, ½ to ⅝ inch diameter, with a succulent epicarp, and a hard bony much pitted endocarp, the perianth-lobes persisting on the top till the fruit is nearly or quite ripe.

Geographical Range.

Portions of the southern districts of New South Wales, South Australia, Victoria, and Western Australia.

Fusanus spicatus, R.Br.

"SANDALWOOD."

TIMBER.

DESCRIPTION AND USES.

This is a comparatively small tree, but the timber being so highly valued, is usually sold by weight, and finds a ready market in the East for the manufacture of small ornamental articles, and also in connection with religious ceremonies. It is also found in several of the South Sea islands, and is an important article of commerce.

Systematic.

A tree attaining 30 feet, with spreading but not pendulous branches. Leaves opposite from oblong-linear to broadly oblong or almost lanceolate, obtuse, or rarely acute, contracted into a short petiole, thick with midrib usually very prominent underneath, the lateral veins very conspicuous, mostly 1 to 2 inches long. Flowers in axillary more or less branching spike-like panicles rarely as long as the leaves, rather crowded and mostly sessile, three to five together on the short secondary branches. Perianth-tube turbinate, about 1 line long, the broad epigynous disk with a prominent free margin. Fruit globular, ¾ to nearly 1 inch diameter, crowned till nearly ripe by the persistent perianth-lobes enclosing a rather broad area, the putamen nearly smooth.

Geographical Range.

Coastal districts of South Australia, and the Coastal and River areas of Western Australia.

Exocarpus cupressiformis, Labill.

"NATIVE CHERRY."

TIMBER.

DESCRIPTION AND USES.

A reddish-brown coloured timber, hard, straight, fairly close grained; somewhat similar in colour and figure to *Fagus Moorei*, "Negro Head Beech," but is harder and heavier. It has a very pretty little silver grain, and is a nice firm-working timber. When thoroughly dry, it should be very acceptable as a cabinet and carving timber, and also for wood turning, marquetry, and joinery purposes. It has also been tried and given satisfaction for golf clubs. (C. W. Chapman.)

H. = Hard. W. = 56 lb. per cubic foot.

Systematic.

Only occasionally does this tree attain a height of over 50 feet. It is quite gregarious, as if staked it will only grow in company with other brush trees. The bark is rough, regularly ridged, and divided into sections. Leaves reduced to minute alternate scales. Flowers minute in little terminal or lateral, very shortly pedunculate spikes, up to ½ inch long. Perianth segments five very small. Fruit a drupe or nut, ovoid or globular, resting on the enlarged succulent red pedicel, about ½ inch in diameter, and known as Native Cherry.

Geographical Range.

Throughout the Commonwealth.

Exocarpus latifolius. R.Br.

"BROAD-LEAF CHERRY."

TIMBER.

DESCRIPTION AND USES.

A very hard, close-grained, interlocked, tough timber of a pale brown colour, and sometimes with a figure resembling Satinwood. The medullary rays are very small and the annual rings very close and compact. It is not obtainable in very large dimensions, but could be used for such purposes as chisel handles, golf clubs (C. W. Chapman), turning, engraving and marquetry.

H. = Very Hard. W. = 70½ lb. per cubic foot.

Systematic.

A small tree, the young parts slightly hoary with a minute stellate or almost scaly pubescence. Leaves alternate, petiolate, from broadly ovate to oval-oblong, very obtuse, coriaceous, with several more or less distinct nerves diverging from the base, 1 to 2 inches long. Spikes rather slender, mostly about ½ inch long, shortly pedunculate, solitary, or several in a short raceme in the upper axils. Flowers five-merous or rarely four-merous, not closely packed. Fruit ovoid, 3 to 4 lines long, on a thickly turbinate, truncate pedicel of above 2 lines.

Geographical Range.

The Coastal areas of Queensland and the Islands adjacent thereto.

Hardwoods in Grades of Hardness.

There has been for a long time an expression of opinion in the hardwood trade that some classification of our Hardwoods is essential, for under that name at present, timbers varying greatly in degrees of hardness are all classed as hardwoods, although they may differ as much as chalk and cheese.

The following classification—the first of its kind and the result of research work here—is offered as a contribution towards the realisation of the trade desiderata in this direction, by laying the foundation for a proper system of grading Australian Hardwoods.

The method by which these data were obtained, is explained in Part I, p. 2.

EACH GRADE IN BOTANICAL SEQUENCE.

EXTREMELY HARD.

Bouchardatia neurococca.
Geijera Muelleri.
Cadellia pentastylis.
Ventilago viminalis.
Heterodendron oleæfolium
Acacia homalophylla.
A. pendula.
A. Cambagei.
Acacia acuminata.
Eucalyptus bicolor.
E. Woollsiana.
E. Bosistoana.
E. microtheca.
E. largiflorens.
E. polyanthemos.
E. populifolia.
Eucalyptus Thozetiana.
E. longicornis.
E. intertexta.
E. salmonophloia.
Xanthostemon oppositifolius.
Macadamia ternifolia.

VERY HARD.

Melicope erythrococca.
Geijera parviflora.
Halfordia drupifera.
Flindersia maculosa.
F. Iffliana.
Emmenospermum alphitonioides.
Ratonia anodonta.
R. stipitata.
Harpullia pendula.
Nephelium semiglaucum.
N. tomentosum.
Acacia binervata.
A. implexa.
A. excelsa.
A. doratoxylon.
A. glaucescens.
Weinmannia lachnocarpa.
Melaleuca styphelioides.
Angophora lanceolata.
Eucalyptus trachyphloia.
E. terminalis.
E. albens.
E. Fletcheri.
E. conica.
E. gomphocephala.
E. hemiphloia.
E. quadrangulata.
E. melliodora.
E. odorata.
E. Rudderi.
E. hybrida
E. affinis.
E. Planchoniana.
E. Dawsoni.
E. cornuta.
E. loxophleba.
E. squamosa.
E. Smithii.
Eucalyptus Fergusoni.
E. paniculata.
E. crebra.
E. Beyeri.
E. siderophloia.
E. sideroxylon.
E. melanophloia.
Backhousia myrtifolia.
Eremophila Mitchelli.
Sideroxylon australe.
Endiandra globosa.
Grevillea striata.
Casuarina stricta.
C. torulosa.
C. Cambagei.
C. Leuhmanni.
C. inophloia.
Exocarpus latifolius.

HARD.

Scolopia Brownii.
Pittosporum rhombifolium.
P. undulatum.
Bursaria spinosa.
Tarrietia argyrodendron.
T. actinophylla.
Bosistoa sapindiformis.
B. euodiformis.
Geijera salicifolia.
Medicosma Cunninghamii.
Pentaceras australis.
Acronychia Baueri.
Halfordia scleroxyla.
Cadellia monostylis.
Villaresia Moorei.
Flindersia australis.
F. Bennettiana.
Siphonodon australe.
Alphitonia excelsa.
Ratonia tenax.
Cupania anacardioides.
C. tomentella.
Nephelium foveolatum.
N. leiocarpum.
Atalaya hemiglauca.
Acacia penninervis.
A. Bakeri.
A. harpophylla.
A. aulacocarpa.
A. decurrens.
Eucryphia Billardieri.
Melaleuca Smithii.
M. linariifolia.
Angophora melanoxylon.
Eucalyptus tesselaris.
E. calophylla.
E. corymbosa.
E. intermedia.
E. eximia.
E. acmenioides.
E. umbra.
E. botryoides.
E. diversicolor.
Eucalyptus robusta.
E. patentinervis.
E. hemilampra.
E. pellita.
E. longifolia.
E. resinifera.
E. microcorys.
E. campanulata.
E. capitellata.
E. carnea.
E. dextropinea.
E. eugenioides.
E. lævopinea.
E. Muelleriana.
E. obliqua.
E. Wilkinsoniana.
E. Macarthuri.
E. pilularis.
E. acervula.
E. citriodora.
E. globulus.
E. nitens.
E. goniocalyx.
E. maculata.
E. Maideni.
E. urnigera.
E. vitrea.
E. dealbata.
E. Parramattensis.
E. propinqua.
E. punctata.
E. redunca.
E. Seeana.
E. Torelliana.
E. rostrata.
E. saligna.
E. ,, var. pallidivalvis.
E. tereticornis.
E. maculosa.
E. ovalifolia.
E. ,, var. lanceolata.
E. fasciculosa.
E. piperita.
Eucalyptus Andrewsi.
E. linearis.
E. Consideniana.
E. virgata.
E. Sieberiana.
E. Nanglei.
Tristania neriifolia.
T. laurina.
Syncarpia laurifolia.
S. leptopetala.
Backhousia sciadophora.
Rhodamnia argentea.
Psychotria nematopoda.
Canthium coprosmoides.
C. lucidum.
Ixora Beckleri.
Randia densiflora.
Monotoca elliptica.
Sideroxylon Pohlmanianum.
Maba fasciculosa.
Notelæa ligustrina.
Olea paniculata.
Strychnos arborea.
Eremophila longifolia.
Avicennia officinalis.
Vitex lignum-vitæ.
Cryptocarya triplinervis.
Beilschmiedia obtusifolia.
Endiandra pubens.
E. virens.
Grevillea Hilliana.
Hakea lorea.
H. leucoptera.
Stenocarpus salignus.
Petalostigma quadriloculare.
Hemicyclia australasica.
Bridelia exaltata.
Dissilaria baloghioides.
Casuarina glauca.
C. suberosa.
C. Cunninghamiana.
Exocarpus cupressiformis.

MODERATE.

Capparis nobilis.
C. Mitchelli.
Hymenosperum flavum.
Elæocarpus obovatus.
Melicope Australasica.
Evodia micrococca.
Zanthoxylum brachyacanthum.
Flindersia Oxleyana.
Celastrus dispermus.
Denhamia pittosporoides.
Ratonia pyriformis.
Cupania pseudorhus.
C. nervosa.
Castanospora Alphandi.
Diploglottis Cunninghamii.
Rhodosphæra rhodanthema.
Castanospermum australe.
Cassia Brewsteri.
Acacia salicina.
A. melanoxylon.
A. longifolia.
A Maideni.
Melaleuca Maideni.
Angophora subvelutina.
Angophora intermedia.
A. Bakeri.
Eucalyptus marginata.
E. Bridgesiana.
E. angophoroides.
E. fastigata.
E. macrorhyncha.
E. Cannoni.
E. patens.
E. regnans.
E. viminalis.
E. Benthami.
E. Deanei.
E. amygdalina.
E. Australiana.
E. Delegatensis.
E. fraxinoides.
E. oreades.
Tristania suaveolens.
T. conferta.
Eugenia Smithii.
E. Coolminiana.
Trochocarpa laurina.
Diospyros pentamera.
Symplocos spicata.
Ochrosia Moorei.
Daphnandra micrantha.
Mollinedia Huegeliana.
Cryptocarya patentinervis.
C. obovata.
C. glaucescens.
C. Palmerstoni.
Endiandra discolor.
Hakea saligna.
Telopea oreades.
Phyllanthus Ferdinandi.
Croton phebalioides.
C. Verreauxii.
Mallotus claoxyloides.
M. Philippinensis.
Baloghia lucida.
Excæcaria Dallachyana.
Aphananthe Philippinensis.
Pseudomorus Brunoniana.
Casuarina Fraseriana.
Fagus Moorei.
Fusanus acuminatus.

PART III.

(*a*) Technical Articles.

I. DETERMINATION OF SPECIFIC TIMBERS.

This section of the study of Australian hardwoods is of first importance, for it is admitted on all hands, as far as the Australian woods are concerned, and in the absence of botanical material, that the most difficult part of the subject is their specific identification when they come into the market, factory, or museum.

Probably in no other part of the world is this difficulty so great, for outside Australia, where commercial timbers may be fewer in number, each species, and certainly each genus possesses certain characteristics that differentiation presents little trouble. As an instance Beech (*Fagus*) has facies common wherever in the Northern Hemisphere the wood is found, whilst the *Fagus* timber of these parts has little resemblance to its Northern congener, although when once known it can easily be identified.

But not so, for instance, with the Eucalyptus woods, which in some cases possess almost indescribable specific differences so that it is often impossible to name a timber for certainty without botanical material. Take, for instance, the "Stringybarks," a very distinct group of trees in the bush, and especially in the herbarium; the xylology of them is another matter, as the specific differences are very difficult to detect both macroscopically and microscopically, and often specific gravity or weight is not of much help, and yet there are differences.

It is only by a constant handling of the respective woods that one becomes familiar with the grain, texture, colour and weight of each—an empirical knowledge that should be supported by accurate botanical information of each species in order to definitely and systematically place a wood.

It will be readily understood that this latter qualification is generally beyond the education or ken of the ordinary timber man. However, the subject of the structural and physical properties is somewhat enlarged primarily in this work for the benefit of the forestry student at least, also for the commercial men who are brought daily in contact with timber, and so it is hoped these notes will assist in the identification of the species of timber for all.

There can be no doubt, however, that a botanical knowledge is most essential to a correct determination at any time.

As the subject of Australian hardwoods covers so many Natural Orders of trees, it is almost impossible to give a complete key to the whole, but something might be done towards this end by classifying thoroughly such features as colour, weight, density, resilience, aroma, bark, approximate growth, appearance of grain in a radial or tangential surface, as well as the character of end grain.

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Then, again, a geological knowledge of rocks and soil is often of great advantage in determining trees in the field. Thus *E. macrorhyncha,* "Red Stringybark," and *E. lævopinea,* "Silver-top Stringybark," both occur in the Rylstone district, and though they closely resemble each other morphologically, yet a bushman will differentiate them at once (apart from the timber) by noting the soil in which a tree is found, the "Red Stringybark" being restricted to sandstone formation, and the latter to the disintegrated basalt or locally called chocolate soil.

This soil differentiation of forest trees is particularly well marked in the limits of the Coast brushes, when the species line of demarcation is clearly defined, and Mr. R. H. Cambage, F.L.S., has given much attention to this subject, his remarks being published in the Proceedings of the Royal and Linnean Societies of New South Wales.

Perhaps the main natural groups in which to class our timbers for identification are Forest, Brush or Scrub, and from these would naturally follow a specific character division denoted by colour, weight, texture, or any other macroscopical feature, and finally by a microscopical examination.

For diagnostic purposes the arrangement and size of the various elements or constituents forming the timber, such as vessels, fibres, parenchyma, must be taken into account, as these are often most helpful in determining the species. Thus the pores (transverse section of vessels) may be large or small, or they may occur with a certain amount of regularity in the spring or autumn growth, or be scattered promiscuously, and such features must be noted when identifying a timber. Then again, the disposition and occurrence of parenchyma (whether plentiful or not), the character, nature, and structure of the fibres, the nature of the deposits in the various wood elements, are all essential to a perfect determination of timbers.

The rays are sometimes helpful for this purpose and this will be seen in the microscopical sections here given of Eucalypts, Grevilleas, Casuarinas, as well as in the coloured plates.

The features above enumerated are mentioned more particularly in connection with the heartwood or duramen, generally the darker portion of the stem.

Professor H. Marshall Ward about sums up this difficulty of identification in these words :—

> "It may be doubted whether all the difficulties are likely to be surmounted. . . . . In any case, while allowing that it is yet impossible so to arrange a collection of pieces of timber, that all kinds can be recognised at a glance, it must be admitted that the attempt to do so at least aids one in determining many kinds."

A satisfactory key to the identification of Australian hardwoods has long been a desideratum amongst timber merchants, architects, engineers, and carpenters, and for many years the author, having under his charge and widely investigated what is the largest collection of timbers probably in the world, certainly in Australia, has also studied the trees in the field, and their botanical characters in the herbarium, in order to evolve such a key, so as to enable a timber to be recognised on sight, or without much trouble, but so far has not entirely succeeded. Several plans have been advanced by authors working on exotic timbers, and founded on macroscopical and microscopical physical characters of the timbers, but empirical methods still seem to prevail in the professions and trades.

As the result of years of experience with timbers, the author has found that the first thing to be acquired in their identification is a colour knowledge, for, just as it has been stated that every flower has a distinct colour, so every timber has a specific colour, although it is most difficult at times to describe such feature, the variations in tints being so very fine. It is the importance of this colour identification that moved the author to produce as many coloured plates as possible.

A scheme based on colour first, then weight, texture, hardness, and grain has been found so far to be the most satisfactory by the author, and it is hoped that the colour-scheme given in Part I will be most helpful in this connection. It is, however, in that large class of the pale woods that the greatest difficulty will be experienced.

In the case of the Eucalypts there is an important adjunct, if procurable, viz., the help of the bark, for by a cortical arrangement, a timber can first of all be placed in its particular class, and next worked out by the other characters; but the species of Eucalypts, under the name of Gums, is not satisfactory in this instance, there being such a variety of different coloured timbers in it, as well as textures and physical properties, compared with the other groups.

Common names, however, are often very misleading, and too much reliance must not be placed on them, for only to give a few instances—"Black Pine" of the Gosford district of New South Wales is *Schizomeria ovata*, Natural Order, Saxifrageæ; "Argyle Apple," of the County of Argyle, New South Wales, is *Eucalyptus cinerea*, Natural Order, Myrtaceæ. The former, of course, is not a Pine (Coniferæ) any more than Putt's Pine of North Queensland, which is a *Flindersia*, neither is the latter an Appletree (Malus). *Acacia Bakeri* is known locally in different districts as Hickory, Brown Marblewood, White Marblewood, Giant Wattle.

II. NOMENCLATURE.

(*a*) COMMON NAMES.

This is one of the most difficult problems connected with Australian hardwoods, and one calling for a reform that must be faced sooner or later by foresters, timber merchants, and all connected with the trade, in order to circumvent the confusion that exists in so many instances in connection with the same species having a different common name in its various localities.

Common names are all very well in old-established communities, such as in Europe, where the number of species is limited, but in a newly-settled country such as Australia, the different timber species are so numerous and common names comparatively few, great confusion has arisen by an indiscriminate use of the latter. Thus we find one common name given to a number of species, such as "Blue Gum" to *Eucalyptus globulus, E. Maideni, E. saligna, E. tereticornis,* and several others. The two former are pale or white timbers and the two latter red timbers, in addition to other distinct characteristics in each, and many similar instances of a mixing of a common name with several scientific ones could be given. Thus endless confusion exists in the timber trade, for one is never sure what specific wood is being marketed under a common name.

Now it seems that the best way to overcome this confusion, and to place our timbers on a perfect commercial basis, is to employ only the scientific names.

(*b*) SCIENTIFIC NAMES.

Many objections have been raised in attempting to use scientific names only, and reasons advanced as to its impractibility, but surely no exception can obtain in view of what has been done in the case of that recent, yet satisfactory trade—the Australian Eucalyptus Oil industry which now reaches fairly large proportions annually, thousands of tons a year being distilled, sold, and exported.

Much confusion existed in that trade when the Technological Museum first undertook research in this field of economics in 1897, for then it was only with the greatest difficulty that oils true to name could be obtained, all and sundry leaves being put in the still. By using scientific names only from the start, the pharmaceutical, perfumery, and other industrial enterprises have in this direction been so much assisted that the industry is placed on such a scientific basis that all orders for Australian oils are given under scientific names, the common names being absolutely discarded and so putting a stop to endless confusion such as one finds in the timber trade.

If this can be accomplished throughout the whole essential oil trade, from oil distillers in the bush to the city merchants and finally the chemist and pharmacist, surely the timber trades are not to be regarded as having a personnel on a lower intellectual plane than, say, the bush distiller.

No better instance of the absurdity of using a common name could perhaps be given than that of the common name "Ironbark," in Tasmania. A person buying a quantity of this, under the impression that he was purchasing a true "Ironbark" species as understood in the mainland, would be more than disappointed to find that he had obtained not an "Ironbark" at all, but *Eucalyptus virgata*, a much inferior wood to the true Ironbark.

In advocating the use of the scientific name in commerce to the exclusion of the common names entirely, I do not go the whole length of employing both the generic and specific name but only the latter. Thus, in speaking of "globulus" timber for *Eucalyptus globulus*, it is quite clear to all timber users which species is meant, and so in Victoria and Tasmania the trade now almost universally speaks of *Delegatensis*, the oil distiller and buyers referred to above, speak of *polybractea*, *Smithii*, *oleosa*, &c., and so these are quite sufficient to prevent any error being perpetrated.

Why then cannot the whole trade follow suit and thus for all time remove the present lamentable chaotic condition surrounding our timber nomenclature.

I regret that the colour plates had been printed before this article was written, otherwise every common name would have been deleted from this work. Someone must make a beginning, and so it will be noted that in the letterpress common names are subordinated to the scientific ones.

III SEASONING OF TIMBER.

GENERAL.

The expression "seasoning of timber" is familiar to all connected with the use of timbers, but it is not easy to explain its application in this connection. It really is an idiom or colloquialism, as the "drying of timber" would very much better express the meaning of the process. However, both expressions now have the same meaning, but really neither is actually suitable, for in the first case nothing is added to the wood, and in the second something more than drying the wood is required to fit it for the market. If evaporating the moisture were all that was necessary the process would be simple, and it could be accomplished by a plain mechanical heat contrivance.

Wood, as we see it, is the result of an abstruse physical building up, and, in the seasoning of it, changes take place other than the removal of the actual moisture. The water rises to the leaves from the roots, carrying a certain amount of mineral substances in solution, and descends through the bark, having by chemical action acquired sugars, resins, oils, gums, and various other substances, and so with these it feeds or builds up, between the bark and wood, the living tissues which make the annual growth of the trunk. It is in this process of building up that timbers acquire their oils, camphors, kinos, resins, and other materials, and in the process of seasoning the presence of these must be taken into account.

Water is found or occurs in fresh timber, as free and absorbed ; the former is contained in the vessels, fibres, and cells, and the latter in the walls of these constituents of the wood. Removal of the water from the cavities of the structure will have little or no effect upon such structure, but as soon as the water contained in the walls of the various wood elements is removed shrinkage begins to take place and other changes also occur. When both the free and absorbed waters are removed the wood is then seasoned or dried. There are two methods employed to accomplish this end, natural or air seasoning, and artificial drying. The desideratum of the trade is to produce this result as quickly as possible, and so, much attention has been given to the latter method.

The different kinds of natural and artificial seasoning have each its advantages or disadvantages; in the former, no control can be exercised over the physical conditions obtaining during the period of exposure, while in the latter operation control is the guiding hand from start to finish. Hardwoods, especially Ironbarks, when in the bulk often crack if air dried. The trouble in this case is no doubt caused by the difficulty of releasing or abstracting the water in the vessels, as its flow is practically stopped by their plugged condition, due to the tyloses in that wood element.

This feature is well seen in Fig. LXXXIII, and is invariably found in Ironbarks, hence the difficulty experienced in the seasoning of these particular woods. This probably also accounts for the cracks in Ironbark baulks, the imprisoned water opening the wood in its efforts to escape by evaporation.

Seasoning therefore requires much more research in the anatomy of the wood than has been given to it in the past, for this study is most essential in order to discover some process of overcoming this obstruction in the vessels. The empirical systems now in vogue are only good up to a certain point, and scientific methods are an urgent desiderata.

Seasoning is a most important factor in the technology of Australian timbers, and more particularly the Eucalypts.

Almost ninety per cent. of our timbers are hardwoods and require much care in seasoning in most instances. In the case of, say Ironbark wood of large dimensions, the seasoning never seems to be accomplished, whatever the length of time may be, for girders that have been in buildings for fifty or sixty years will often warp after removal if a plank is cut from one side, in fact, another piece on the opposite side would have to be taken off to straighten the beam. This feature can be accounted for now that the anatomy of some of our timbers is known.

In olden times, nothing but natural or open air seasoning was ever undertaken, and in this connection no better example can be given than that followed at the Government Dockyards in England in the days of wooden ship-building.

Timber was then stacked for a number of years, sometimes under cover, sometimes not, according to a particular plan, consequently when it was required it was thoroughly seasoned.

The amount of moisture varies in different woods and in some species, such as those of the Eucalypts, timbers are found to contain as high as 50 per cent. of water.

The object of seasoning is (1) to extract the sap or water in order to prevent shrinkage after the timber is used, for once a timber is properly dry it will not contract or expand unless brought in contact with moisture, and (2) also to reduce the weight. But if the seasoning process is carried too far, however carefully, the tendency is towards brittleness.

Timber requires to be prepared before undergoing the process of seasoning, and it will never season satisfactorily with the bark on or sapwood attached. The ancients accomplished their seasoning by ringbarking or girdling the standing tree and not cutting it down till perfectly dry. Timber so prepared is exceptionally hard and durable, but modern saw-millers look askance on such as it dulls or deadens the saws too quickly; in fact, timber thus prepared has been known to become so hard that an axe will only cut it with difficulty.

This method, however, has been practised in Australia, for one saw-milling expert states "he found that it paid to girdle the trees, and allow them to stand for, at least, twelve months before felling, the weight of the girdled sawn timber Ironbark being 5 to 5¾ lb. per super. foot, and of the green, ungirdled timber, 6½ lb. per super. foot. But this was not the only benefit. The timber, which was partly seasoned on the stump, and sawn as much as possible radially, did not twist, crack or shrink as did the unringed green timber which was sawn anyhow, and it also retained its shape very much better after having been sawn."

The girdling method of seasoning on the stump has been carried out in India and Burma, especially in the case of Teak timber, which has to be girdled at least three years before the Indian Forestry Department will allow the tree to be felled, and from four to five years before it is allowed to be sawn.

In Great Britain seasoning is accelerated by only felling the trees after the leaves fall, and thus when the sap is down; but as our hardwoods are all evergreens, the same condition in regard to the sap does not hold, although the sap may be less active in winter.

It must be remembered that the rate of drying depends largely on the shape and size of the piece, an inch board drying more than four times as fast as a four-inch plank, and more than twenty times as fast as ten-inch timber.

The principal methods of seasoning are the following :—

I. NATURAL SEASONING.

(*a*) HORIZONTAL PLAN.

In this case the timber is stacked in the open so as to allow a free current of air to circulate around each piece, just as in a brick kiln the bricks are so arranged that the heat plays on each individual brick.

Pieces should not be stacked one on the other, but with strips of narrow wood placed at intervals between each. Special care is required in choosing these strips; they should be selected and well seasoned, as cases are known where Oregon and

other imported Pines have been used in which fungus has germinated and ruined the whole stock, the cause of such being due to the presence of spores in these damp strips. Laths with an acid cell content should be discarded, as it stains the planks badly. The planks should not be stacked quite horizontally, but with a slight slope so as to allow the rain to run off.

Timber so arranged ought not to be left for long periods without being turned over from time to time. Two to three years is the time generally given for it to remain in the open. It should then be placed under cover, with spaced battened sides to allow a free current of air, and be left as long as commercial exigencies will allow.

Perhaps the best example of the above methods is to be seen at the Railway Construction Works, Newport, Victoria, and at Pengellys, Adelaide, South Australia, and H. McKenzie, Ltd., Glebe Island, N.S.W. At Newport the logs are first exposed to the weather, then cut and stacked from one to two years in the open, and finally placed under cover for a further period of years, before being used. See Figs. LXXXIV, LXXXV, LXXXVI, LXXXVII, LXXXVIII.

FIG. LXXXIV.

Horizontal method of seasoning timber, Tasmania.

Wood from young trees (Eucalypts) more readily warp than wood from mature trees, but the rule given above is applicable to all timbers. The stack should be as high as possible so as to obtain weight, which will minimise the warping and twisting during seasoning; in some cases, weights are actually used.

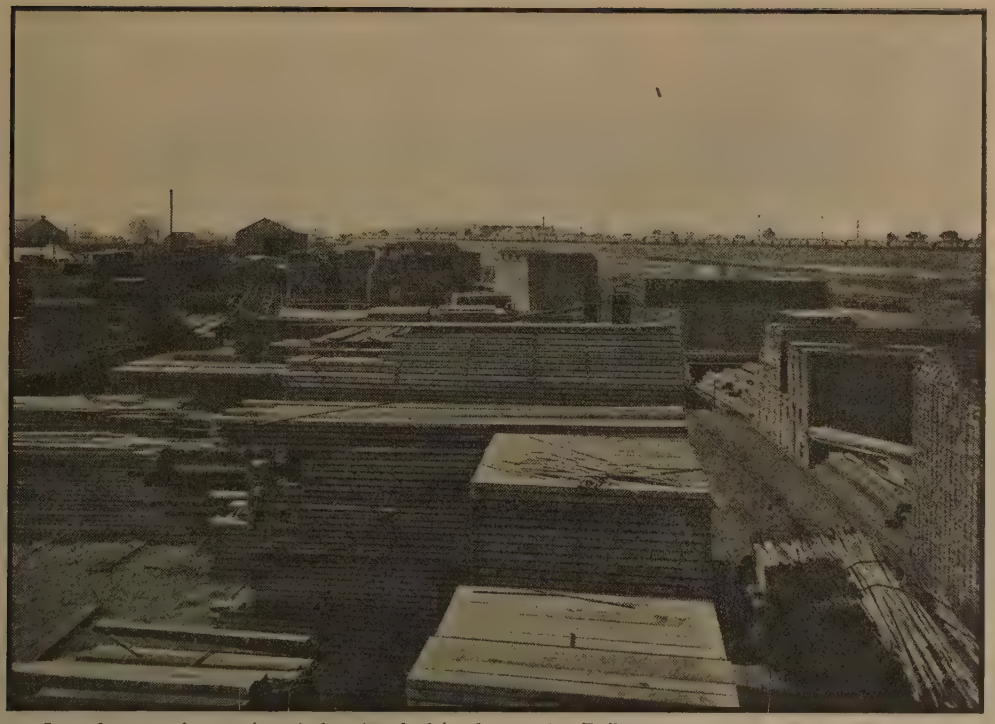
FIG. LXXXV.

Horizontal method of seasoning timber. H. McKenzie, Sydney.

FIG. LXXXVI.

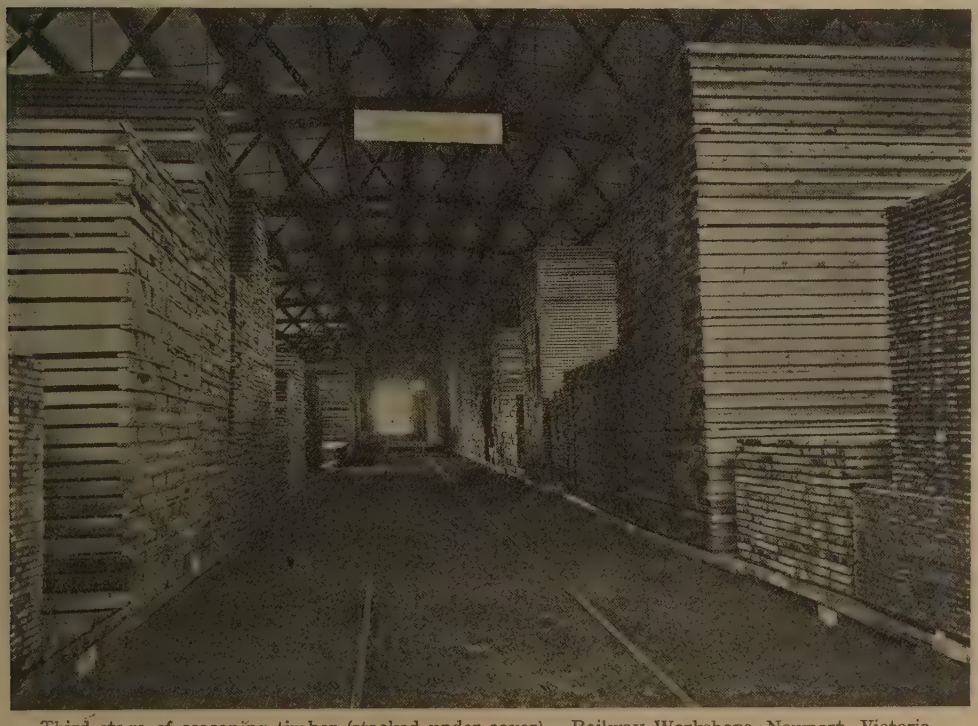
First stage of seasoning (in the log). Railway Workshops, Newport, Victoria.

FIG. LXXXVII.



Second stage of seasoning timber (stacked in the open). Railway Workshops, Newport, Victoria.

FIG. LXXXVIII.



Third stage of seasoning timber (stacked under cover). Railway Workshops, Newport, Victoria.

(*b*) OBLIQUE PLAN

Another method of natural seasoning timber is by standing the planks exposed to all weathers on end at an angle supported by a horizontal pole, the planks alternating on each side of the rest, the pieces being turned from time to time. See Fig. LXXXIX.

FIG. LXXXIX.

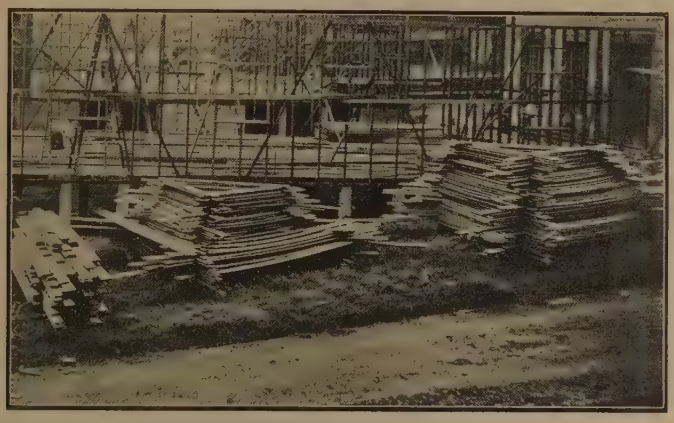
Oblique stacking of timber for seasoning. H. T. Russell & Sons, Tasmania.

It is claimed that this is a quick and satisfactory method, and certainly furniture made from timber so seasoned has stood very well when in use, showing no signs of warping. This method, practised in Victoria and Tasmania, appears to answer very satisfactorily with Eucalyptus timbers such as *E. obliqua,* and *E. Delegatensis.*

(*c*) TRIANGLE STACKING.

The method of stacking timber in a horizontal triangular form, finds favour with some and is regarded as satisfactory. See Fig. XC.

FIG. XC



Triangular stacking of timber for seasoning.

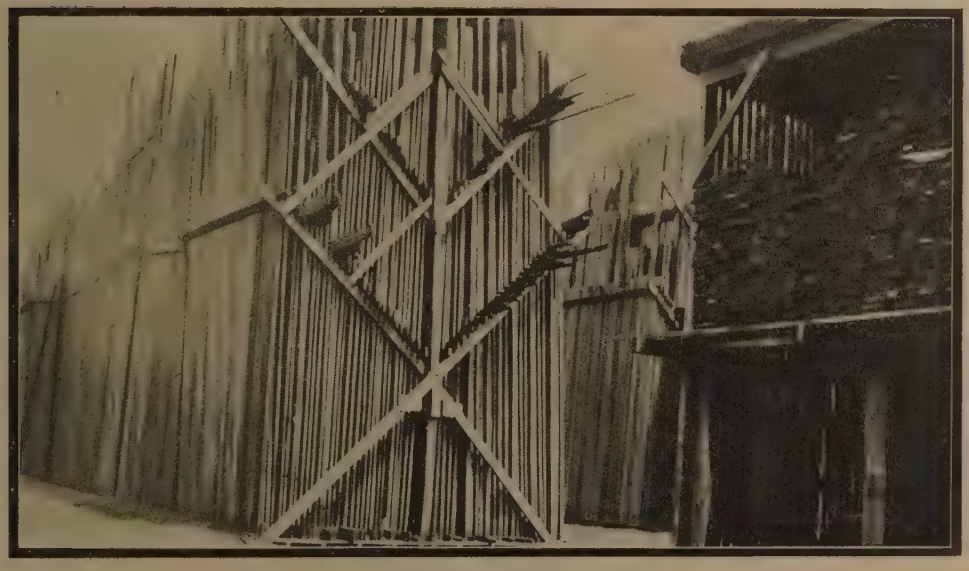
(*d*) PERPENDICULAR.

American furniture manufacturers have taken of late years considerable trouble in the seasoning of hardwoods, especially maple, and obtained satisfactory results by drying timber on-end in sheds.

The weight of the timber rests solely on independent foundations and does not depend on the shed foundation for support. In fact the entire function of the shed is to help hold the timber in a comparatively upright position and to protect it from the weather.

So far this method has only recently been adopted in Australia, and by Young, Marshall & Co., Caulfield, Melbourne. See Fig. XCI.

FIG. XCI.



Perpendicular method of seasoning timber.

(*e*) SEASONING TIMBER UNDER WATER.

There can be no question that seasoning is much accelerated by immersing logs or timber in water, a running stream for preference.

The wood is not actually dried under the water, of course, but is freed from the live sap (which retards air-drying and causes it to stain), thereby putting the stock in condition for quick air or kiln drying, and so made ready earlier for use.

This method is especially applicable to softwoods, but there is no reason why it should not be tried with our hardwoods.

A quantity of pine tested in this way (after thirty days' immersion) was found to have kiln dried out in four days, as against nine to twelve days for timber not so treated, and that submerged and exposed to air for fifty days was then quite dry and ready for use.

(*f*) EXAMPLE OF SEASONING.

As an example of practical seasoning of smaller specimens of our hardwoods, the following will be of great interest in this connection.

A very successful New South Wales coachbuilder, James Bennett, of St. Mary's, as the result of about forty years' practical experience and close observation, uses the following methods for seasoning his timbers :—

NAVES AND HUBS.

The trees for these are felled from 1st June to the middle of August, as no other time of felling has been found to be suitable. The timber is cut into lengths, turned, bored, and holes for the spokes are bored right into the centre hole, thus allowing a free circulation of air through every part of the nave.

These are stacked in a close shed with very little air so as to dry slowly. They are next well oiled and after twelve months removed to sheds, getting more light and air. After two or three years they are painted with red lead and moved at intervals and then stacked in single tiers in sheds open in front. Next they are fully exposed to the air and sun, but roofed to protect from rain. Heavy waggon naves are not used under any circumstances unless seasoned for ten years.

The same holds for spokes except that they are used after five years. Before the spokes are put into the naves they are stacked round a boiler where they are made as hot as they are ever likely to be when exposed to the sun in any part of Australia.

The same care is given to the timbers for the frames of the vehicles and consequently no fault is found with our hardwoods when so thoroughly treated.

LOG SEASONING.

To prepare logs for seasoning it is first necessary for the bark to be removed and the timber next cut into shapes and lengths likely to be required.

In no case should logs be seasoned with the bark on, for the result would be disastrous as they split badly when so treated. The vessels and fibres of the wood contiguous to the radiating medullary rays part with their moisture quicker by the aid of the rays, and so evaporation is further assisted by the radial splitting of the logs.

Logs are best seasoned by first removing the bark and sap-wood, and then placing them in water (running for preference) a full period, and afterwards stacking them under cover from the sun and weather. The ends should not be painted or covered, but

left free for the moisture to evaporate, for if not allowed to escape it will cause fungus growth, and as this grows the wood decays. In Tasmania the large squared logs of *E. globulus* are exported with a ring of iron placed on the prepared rounded ends.

Splitting or Checking.

It is only too well known by those interested in the timber trade that losses amounting to several thousands of pounds annually are incurred owing to the splitting of logs. Felled trees begin to crack and split at their ends after a very short period, thereby rendering useless a good portion of the wood, and so in calculating the volume of trunks and logs the parts thus affected are always left out of the reckoning. These troubles make themselves obvious, especially in the case of hardwoods, which are more subject to splitting than softwoods, thus causing extensive losses, and these might be avoided if means were taken to prevent such splitting.

The cause of wood splitting can be easily explained when one takes into consideration the structure of the timber and its attitude when brought into contact with humidity. It is known that thin planks contract as soon as they dry, and expand when affected by the dampness of the atmosphere. As the vessels lie principally in the direction of the fibres, it is easily understood that the timber begins to dry at its ends in the first place because the open pores give up their moisture very quickly, whereas towards the middle of the timber the humidity in the vessels remains much longer. Besides this, the air penetrating the pores to take the place of the water, oxidises, and therefore hardens the sap, which naturally accelerates the drying up process. Now, as wood shrinks when it dries, it is quite natural for the ends of the timber to contract transversely, and as the middle parts which are still moist cannot follow this pressure, the consequence is that a certain tension is brought about, causing the wood to split.

II. ARTIFICIAL SEASONING.

Many artificial methods have been patented from time to time, and new patents are continually being taken out for quick or rapid seasoning, and the list of these would be too long to particularise here, but the following two are given as examples :—

(*a*) ELECTRICITY.

One of the latest is the utilisation of this particular power form of nature. In Australia, Messrs. Alcock & Co., at their Melbourne factory, have patented their method of seasoning hardwoods by electricity, a photograph of which is here given and the pieces of timber to be treated.

Mr. F. A. Alcock states "that in 1909, owing to the shortage of seasoned timber for the manufacture of billiard tables, I again attacked the problem of seasoning, when I discovered that with newly felled timber the amount of sap contained provided sufficient electrical conductivity to produce a rise of temperature in the sap pipes or ducts of the timber when electricity was supplied at a suitable voltage. With this information it was a simple matter to devise means for the efficient application of the electricity so as to handle timber in the newly felled log or in the form of planks or boards, &c. The plant required consists of a cheap source of electric supply, which is supplied at an alternating potential; the voltage varies with the class of timber, by means of special electrodes which are placed on the timber and controlled from a switchboard which enables the voltage to be varied as desired.

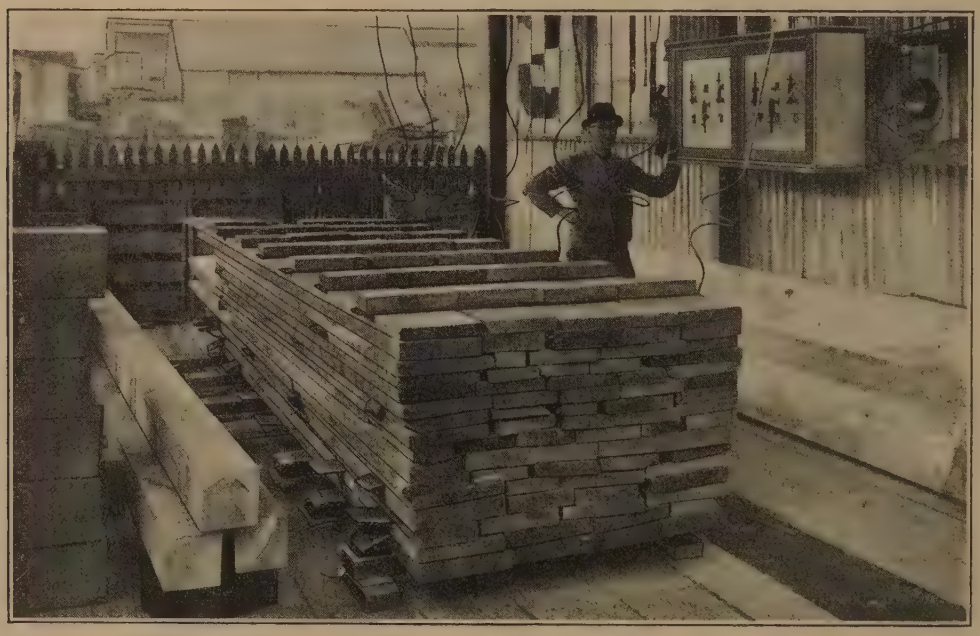
The advantage I claim for this electric system over both natural seasoning and air circulating systems, is that by creating a temperature rise in the sap ducts of the timber an internal pressure is produced within the ducts which retain the walls while the sap is being released. The effect of this internal pressure in the ducts is to preserve the structure of the timber during the process of releasing the sap which is just the reverse of that which obtains with natural seasoning or artificially applied heat by the various air circulating systems. A proof of this claim has been demonstrated by the inappreciable shrinkage observed in the Blackwood that has been treated in our South Melbourne factory.

The best results, however, in the electric method are obtained with newly felled timber, hence the ideal condition is to treat the timber in the log at the time the tree is felled in the forest."

A somewhat similar process is said to have given striking results in France. It consists of passing an electric current through the timber lengthwise, the centre of the piece being treated becoming very hot and the boiling sap is forced outwards. After the electrical current the wood is given natural seasoning until it is thoroughly dry.

A water-tight tank of suitable size is used in which the timber is piled on a large lead plate at the bottom, until the tank is full, when a second plate is placed on top of the pile and connected to the positive pole. The space around the timber is then filled with a solution containing five per cent. of resin, ten per cent. of borax, and a trace of carbonate of soda. By turning on the current, it passes from plate to plate through the wood, driving out the sap, and the resin and borax takes its place in the cells and interstices. This process being completed, the timber is taken out and dried, when it is ready for use. See Fig. XCII.

FIG. XCII.



Seasoning of timber by electricitv. Alcock & Co., Melbourne, Victoria.

(*b*) KILN-DRYING.

This method is, of course, opposed to the slow, yet very satisfactory, process of atmospheric removal of the contained water of the wood, and so acceleration is the watchword.

It is easy to remove the free water (that contained in the cavities of the wood elements) from timbers which will stand a high temperature as it is only required to subject the timber to a few degrees above boiling point in a closed chamber, and permitting the steam to escape, but excluding dry air so as not to allow the surface wall structures to part too quickly with its absorbed moisture and so form a skin. This is applicable to softwoods, but not always to hardwoods, as the required high temperature may prove injurious.

But it is in the removal of the absorbed water (which is contained in the walls of the wood elements) that care must be taken, for as soon as this evaporation begins to take place shrinkage commences in the walls of these bodies, and so strains are commenced which give rise to cracks; to obviate this the absorbed water must be removed by gradual transfusion instead of boiling. Thus the proper seasoning of timber means more than merely getting out the free water, for the actual loss of water from the cell walls causes them to become strained or shrivelled, consequently seasoning may produce a weakening effect. Some green timbers will stand greater breaking strain than a dry specimen.

In this connection Mr. H. D. Tiemann, of the American Forestry Service, gives the following advice concerning his experiences in kiln-drying :—

Attention should be given to the undermentioned factors :—

1. The lumber should be heated clear through before drying begins.

2. Humidity should be correct at the start and reduced in the proper ratio as the drying progresses.

3. The temperature of the lumber should be uniform and as high as the kind of material will endure.

4. The rate of drying should be controlled by the amount of humidity in the air and not by the rate of circulation. The circulation should be ample at all points to supply the heat needed for vaporisation and to keep the humidity uniform. To evaporate 1 lb. of water at atmospheric pressure requires the amount of heat given up by 69,000 cubic feet of dry air in falling 1 degree Fah. The regulation of the humidity is to prevent the surface from drying down to the point where it takes "set" before the interior has dried to nearly the same amount, thus preventing case hardening. If dried too rapidly case hardening will result.

5. The degree of dryness obtained should conform with the use to which the wood is to be put.

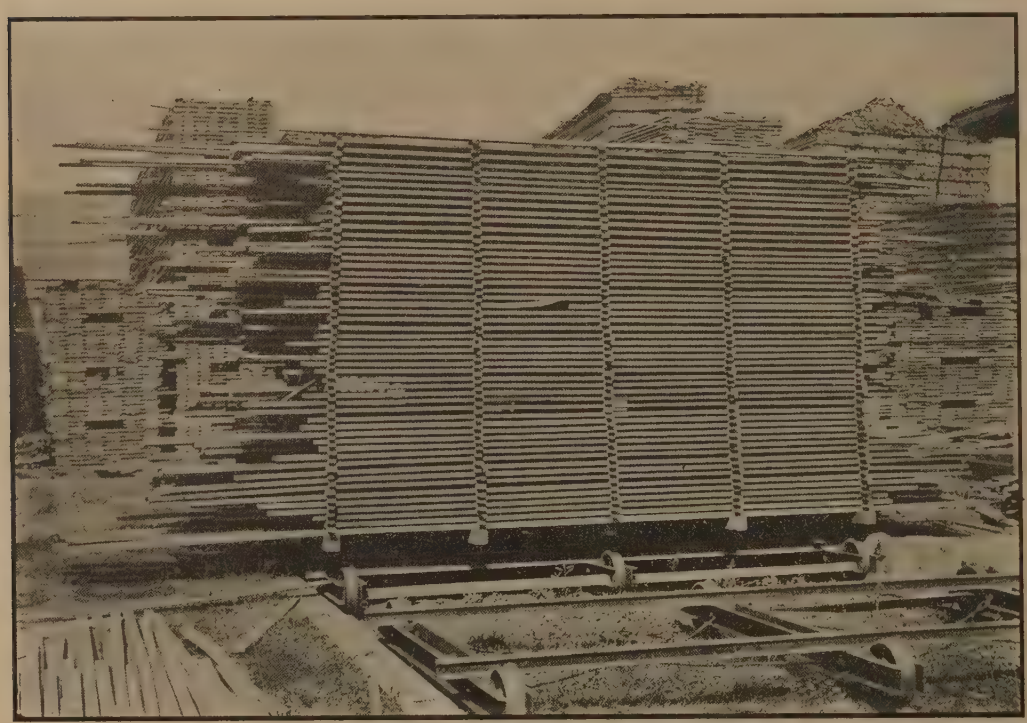
Ideal drying depends upon ample circulation, control of humidity at all times, and proper temperature.

Any kiln which fulfils these conditions should be capable of giving perfect drying.

Many kiln drying patents are on the world's markets, and some can be seen in operation in the chief cities of Australia. Several methods of kiln drying are known, each varying in its plan of stacking the timber to be treated, and the arrangements of steam heated pipes and control of hot or cold air. Those most generally in use are

(1) the compartment system, where the wood is stationary throughout the drying process and the regulation of temperature and humidity is varied by mechanical contrivances from day to day as the process proceeds ; and (2) the progressive system, of which there are two factors, the moist and dry air. Figs. XCIII-XCV show the kiln drying by moist and dry air method used by H. McKenzie of Sydney. In this case, the result of much experience, it is found that the best data were obtained by first running the timber (stacked on trucks) into an atmosphere charged with steam, and then moved on to a hot and dryer atmosphere for a certain period, the hot air rising from the steam horizontal pipes in the floor. The trucks are next gradually moved by stages in periods of days towards the other end in this dry heat, and finally out into the normal air. The heat is kept under control, a thermometer registering the required temperature. The temperature is run at about 120 to 140 degrees Fah. At this heat softwoods are considered to be seasoned in one week. Hardwoods are run at a lower temperature of about 120 degrees Fah. and take about fourteen days to season, that is one inch stuff in both cases. The steam is turned off at night, consequently the temperature drops, although the timber still remains quite warm.

FIG XCIII.



Kiln-drying of timber; load on truck. H. McKenzie, Sydney.

There is no air forced into the kiln, but there is a certain amount of ventilation under the floor and canvas blinds at each end. At the sides there is a chamber about 8 feet high and 6 inches deep, the inlet to which is under the trucks, the idea being to create a circulation of the air in the kiln. At the moist end of the kiln in the side walls, about 6 feet up from the floor, are two small openings which can be opened or

shut at will. These are the only outlets for steam or hot air which passes through them upwards between the wall, over the roof, and eventually escaping through the ventilators in the roof, as seen in Fig. XCIV. The object of this kiln is to dry the centre of the timber first with moist air, and moving it along the kiln, the humidity getting less as the timber passes towards the exit. This is called the progressive type.

A very important point in this process is the temperature, care being taken not to work at too great a heat. Experience has shown that hardwoods season best with a lower temperature and longer period than softwoods. By this method it is claimed that the inside of the timber is dried first.

FIG. XCIV.

Photo.] [*C. F. Laseron.*

Kiln-drying; exterior view of the kiln, showing trucks. H. McKenzie, Sydney.

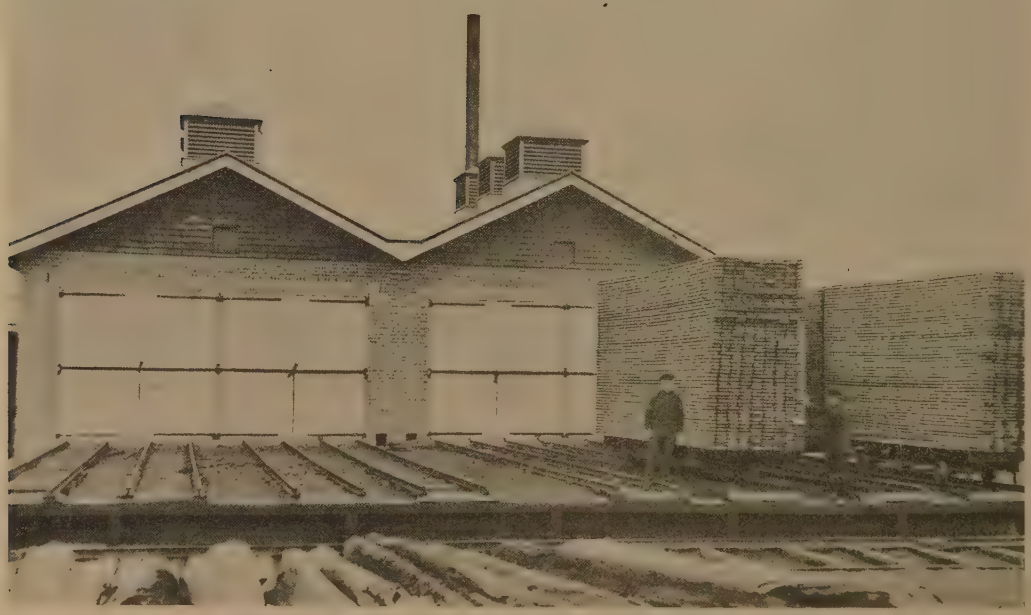
In some kilns the reverse of this, or dry-air, obtains, the dry-heated atmosphere passing over the wood towards the exit end and gaining moisture on its way to the other end of the building or tunnel, where the wood enters on trucks. The temperature varies in kilns from 70 to 200 degrees Fah., according to the nature of the timber treated. This is called the Erith method. Fig. XCVIII.

In the way carried out by the Forestry Department at Newport, Victoria, the process of which is a secret, it is claimed that very satisfactory results are obtained with tongue and grooved hardwood boards, *E. Delegatensis,* 1 inch thick, the period of treatment only occupying a few days, moist air being circulated through the drying kilns.

FIG. XCV.

Photo.] Kiln-drying; interior view of kiln. H. McKenzie, Sydney. [*C. F. Laseron.*

FIG. XCVI.



Kiln-drying. Exterior view. Forestry Department, Victoria.

It is still an unsettled question whether kiln-drying timber does not reduce or affect the strength and durability of the wood. Before kiln-drying it is usual to first season the timber for a short period of months, which, of course, reduces its hygroscopic capacity, and also its warping.

FIG. XCVII.

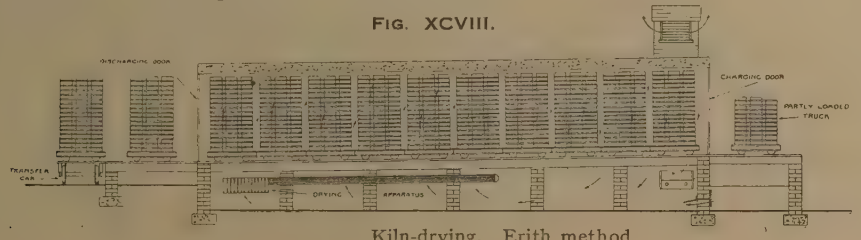
Kiln-drying. Interior view. Forestry Department, Victoria.

In the treatment of hardwoods too rapid kiln drying causes case hardening, that is a thin skin of dry wood, causing the inner wood to crack and split. Kiln defect, however, is somewhat obviated by previous natural seasoning.

The temperatures required in kiln drying of our hardwoods have not yet been definitely ascertained, only a few so far having been treated, and the temperatures so employed have not been divulged, but it probably ranges from 100 to 130 degrees Fah., after first being for a few months air dried. Much scientific research is still an urgent necessity as regards the seasoning of our hardwoods.

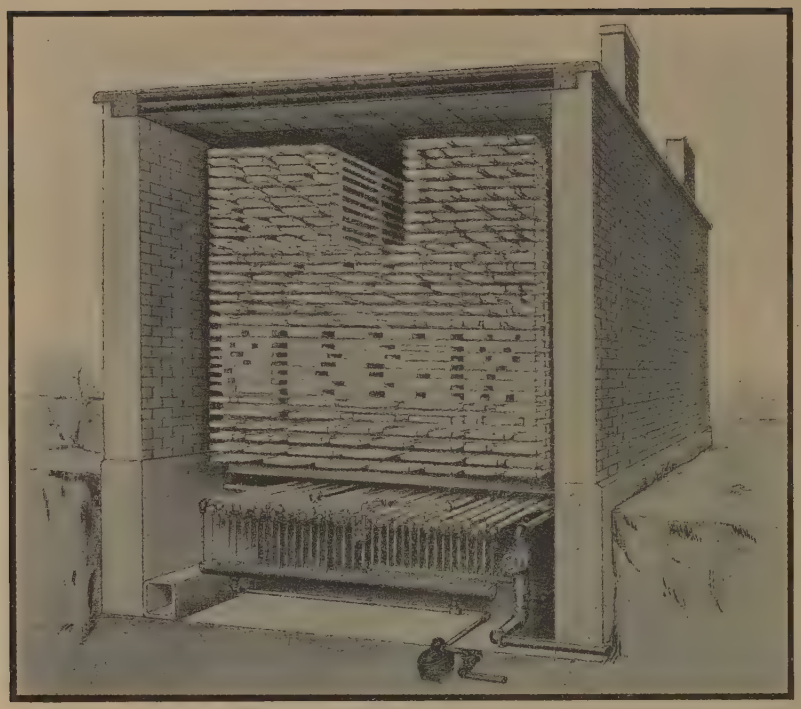
The progressive dry kiln is shown in Erith's system, Fig. XCVIII, only drying apparatus being used.

FIG. XCVIII.



Kiln-drying. Erith method.

FIG. XCIX.



Kiln-drying. Oliver method.

"OLIVER" DRY KILN—GRAND RAPIDS VAPOR PROCESS.

Holding Capacity—5,000 ft. board measure.
Size Inside—18 ft. 10 in. x 10 ft. x 10 ft.

Steam—2-5 lbs. live or exhaust.
Pressure, sq. ft.—Approximately 400.

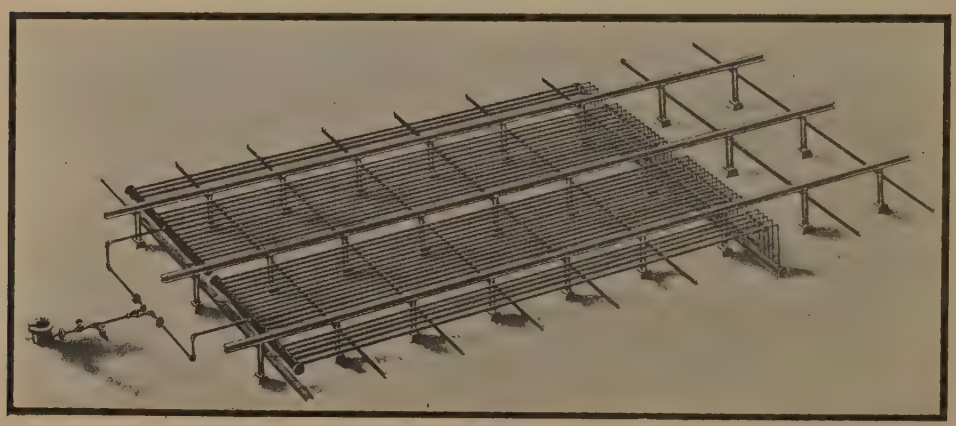
Radiation Drying Time—Based on 4-4 rough lumber, six months air dried:

Oak	... ...	25 per cent.	to	5 per cent.	10 days.
Other hardwoods,	25 ,,	,,	5 ,,	8	,,
Softwoods	25 ,,	,,	5 ,,	5	,,

For steam, day times only, add half to length of time.

Output—Average daily: Oak (as above), 500 ft.; Other hardwoods, 600 ft.; Softwoods, 1,000 ft.
When run full capacity with twenty-four hours' steam.

FIG. C.



Kiln-drying. Pipe-heating apparatus.

The following extract from *The Timber News*, London, 2nd November, 1918, is of interest in kiln drying of large baulks of timber :—

> In a "Stirling" timber-drying kiln, recently erected in the north, some oak beams, 14 by 9, for Class A war material, were seasoned in fourteen days; this wood was home grown, and perfectly green. Some spruce, also green, had 40 per cent. of moisture taken out in the same time.
>
> It is not possible to obtain results like this without the temperature and humidity of the air in the kiln being under perfect control, and only long experience will ensure the right proportion of either; too high a temperature will crack the wood, and too much humidity will slow the drying.
>
> No fans or other moving parts requiring power are required for these kilns; a perfect, natural system of ventilation and circulation of air is obtained, and another advantage is that the drying process goes on all night, without any attention whatever; the wood refuse is quite good for fuel.
>
> A large "Stirling" plant has just been erected in one of the Admiralty dockyards, and they are being erected in all parts of the country and abroad, and are seasoning huge quantities of home-grown timber for aeroplanes, military waggons, shell boxes, gun platforms, and the like.
>
> These kilns are arranged either on the progressive or compartment system; in the progressive system the timber is on trucks in tunnels, and as one truck of green timber is put in at one end of the tunnel it pushes another truck of seasoned timber out at the other end; but for a general trade the compartment system is the better, because different kinds of wood can be seasoned at the same time, hard and soft woods, and of different thicknesses; the wood is just stacked in the kiln and left for a certain number of days, when the thin wood which dries quickly is taken out first, and, what is only possible in a few kilns, more thin wood can be put in without disturbing the thicker or harder wood; in this way a continuous system of seasoning is obtained.
>
> It is not by any means always necessary to erect a new building for this system; dozens of "Stirling" plants are working to-day in old buildings, adapted for the purpose, some of which are wooden erections, we are informed.

The Powellising process is explained under "Preservation of Timber."

In concluding this article, record must be made to the work of Mr. V. B. Trapp, of Melbourne, who has given so much attention to the study of the seasoning of our hardwoods.

IV. PRESERVATION OF TIMBER.

The oldest method of preserving timber, and one often used to-day, is that of charring before being placed in the ground. It was practised by the ancients even as far back as prehistoric times, and is common throughout Australia.

Soaking timber or burying it under corn were methods of seasoning practised by the Romans, who also steeped wood in oil of cedar to protect it from the attacks of worms.

In our cities telegraph and electric light poles, and on the railway, signal posts are embedded in the ground in a casement of concrete or cement, which acts as a resistant against white ant attacks, and in addition treated periodically with a wood preservative.

Many ways of timber preservation have from time to time been placed on the world's timber markets, but it is only intended here to explain a few of the more important, and as a rule these are particularly applicable to what are classed as softwoods, and from which it is required to get the maximum amount of, or perhaps more correctly to obtain an excess of, durability over the wood's natural life by the assistance of artificial means.

In recent times many inventions have been advanced as timber preservatives, the latest in Australia being the Powellising process.

Mr. Powell has devised a process for preserving timber, and claims to have proved that timbers can be thus greatly improved by being boiled in sugar (molasses) solution and arsenic, and afterwards dried in ovens heated to a suitable temperature according to the wood dealt with. It is claimed that panels made of quite green wood from newly felled trees, immediately after being treated in the manner described, will stand very great extremes of heat and cold, dryness and damp without warping or "giving" in any way, and also that Powellised timber will stand greater strain than untreated wood, and not only can cheaper products be made to do the duty of more expensive ones in the manufacture of mangle rollers, chair legs, pattens and pit props, but difficulties that always have existed can be overcome, and ornamental finish be given which before was lacking. For fencing, paving blocks, and so on, Powellised wood is also claimed to be exceedingly useful.

Other important series of preservation are those which may be termed impregnation methods. These all depend upon the principal that the sap may be replaced by some substance that is antiseptic or poisonous to fungus-germs. The most primitive of these is merely to paint with a substance, such as tar, as thickly as possible over dry wood, and let it soak in, and this undoubtedly has a great preservative effect, even on sapwood or wood very imperfectly dried; but the principal drawback to this, and the chief difficulty in several other impregnation processes, is the very small distance upon which the liquid acts, so that slight cracks expose unprotected wood to fungus attacks. Whilst it is comparatively easy to inject into sapwood in a longitudinal direction, it is more difficult to inject into heartwood; and it is very much easier to force liquids through wood longitudinally than radially.

An improvement on any painting is to submerge the timber in a bath of the preservative, which may be tar, sulphate of iron or of copper, chloride of zinc or creosote; the replacement of the water, air, and sap in the wood by the liquid will generally be hastened by heat. Penetration is, however, slight, and long submergence renders the timber brittle.

Of the materials employed for impregnating timber, the most extensively used is creosote, originally suggested by Bethell, and now very largely employed in various ways. It is cheap, lasting in its effects, and useful in rendering the wood damp-proof.

A more complicated and costly, but very successful, process consists in the use of air-tight chambers, in which the converted timber is placed. The air is then partially exhausted so as to draw out some of that in the vessels of the wood, and the antiseptic solution is then forced in by pumps, preferably with steam or heat, the whole time occupying less than an hour. About 75 lb. of creosote, however, are required for the impregnation of an ordinary railway sleeper, and various attempts to reduce this quantity by the use of some liquid solvent have failed. It has been proposed that the timber be first steamed under pressure, the air next exhausted, and then an emulsion of fifteen per cent. of creosote, in a resin soap to which water is added, forced in under seven atmospheres.

Creosoting is really injecting under pressure into properly seasoned timber, distilled coal tar. The creosote oil at a temperature of 60 degrees Fah. is said to have a specific gravity 1·045, and to contain not less than ten per cent. of crude carbolic and other tar acids. The temperature of the creosote when injected into the timber is not less than 120 degrees Fah., and the pressure is not less than 150 lb. per square inch.

In the United States of America creosoting is more particularly used in connection with softwoods for railway sleepers and has assumed large proportions, hardwoods being too costly and not procurable in sufficient quantity for this purpose.

The most effective is perhaps corrosive sublimate (mercuric chloride) as a preservative, the use of which is known, from its inventor, Kyan, as Kyanising. It forms insoluble compounds in the wood, and is, therefore, permanent; but its costliness and dangerously poisonous nature are against its general use. Zinc chloride, introduced by Sir William Burnett, is cheap and effective against both insects and fungi, but less so than creosote. Copper sulphate, sometimes used for sleepers in France, is cheap, but is deposited in crystals in the wood, rendering it brittle, and owing to its solubility, is as easily washed out as it is injected.

The more expensive carbolic acid and ferric tannate have also been tried.

To force the antiseptic solution into the wood, M. Boucherie, who first employed copper sulphate, proposed placing it in an elevated reservoir, connected by a pipe with the lower end of a log; but this requires the log to have its bark on, and is thus a wasteful process.

Fortunately for Australia, the expense of using preserved sleepers is saved the State railway departments, as the life of our hardwoods in this connection is sufficiently long as not to warrant any monetary outlay on them. Hardwood blocks, treated by certain processes, for road-making, are being experimented with, but it is too early to speak of the results in comparison with the patent preservatives now in use. Mr. H. H. Corbin, B.Sc., Adelaide University, is carrying out experiments with our hardwoods by the creosoting and other methods.

Such impregnations double or treble the life of railway sleepers. On the other hand, it should be remembered that paint prevents not only the entrance of moisture, but also its exit; so that if applied to imperfectly seasoned wood it merely causes dry rot which finds a sufficiency of moisture in the wood. Even perfectly seasoned wood, if not protected by tar or paint, requires good ventilation if it is to last. Warm, moist, and stagnant air, and partial contact with moist earth or water, are the most unfavorable conditions for the durability of timber.

One of the latest plans employed for the preservation of wood is that by Epinoy, who utilises the property of the alkaline bichromates to render gums and gelatines soluble when exposed to light. For this purpose the wood is immersed until completely saturated in a solution containing 2 per cent. bichromate of potash and 1 per cent. fluorose of sodium, and, after drying, is proof against rotting. It is then painted with a solution containing 2 per cent. bichromate of potash, 0·4 per cent. fluorose of sodium, and 5 per cent. of gelatine, and is exposed to the light; after drying, it will be found to be covered with a very strong brilliant varnish, and assume a brown colour, like aged wood.

One important factor must be borne in mind in dealing with this subject, viz., the structures of individual timbers. Excepting the Pines or Coniferæ no two species of timbers are histologically the same—in the former the woods are more penetrable than those of the latter.

This penetrability of timber is of great commercial importance in view of the terrific rate at which our forests are being destroyed, so that whatever timber is left will have to be used very sparingly and every effort made to add to its durability by scientific methods.

It is very necessary before treating any timber with preservative ingredients that it should be perfectly seasoned, as green timber contains large quantities of water which prevents the passage of such through the wood elements, whilst in the case of dry wood this water being removed gives a free access to them. In other words, this exclusion by green timber is owing to the vessels and other elements of the wood not being in a condition to allow the preservative to operate, owing to the presence of water and tyloses in the cells of the vessels, and so it is found that the imperviability of a wood is considerably increased when in a green condition.

The penetrability of a timber is also governed by the number and condition of the vessels and amount and condition of the parenchyma, which are avenues through which the interior structure can be reached.

Thus in Eucalyptus timbers, the vessels, parenchyma (wood and ray) and even the fibres are often plugged with a solid substance. Where the fibres predominate and are closely packed, and have thick walls as in Ironbarks, absorption is very difficult; and, further, most of our hardwoods have the vessels plugged with tyloses—cells formed by the protrusion of the inner surface of the thin parenchyma walls into the lumen, a circumstance which naturally retards or almost blocks the channel.

It is this condition of things which obtains in most of our hardwoods, especially the Eucalypts, hence the difficulty in thoroughly permeating them with preservatives, and in view of this the author considers that our hardwoods need no special preparation when used as sleepers.

(*b*) Uses of Australian Hardwoods.

The utilisation of our hardwoods by the architect was necessarily very much more in evidence in the early days of the Colony than at the present time, now that iron, stone, bricks, and reinforced concrete have come into their own and which add so much beauty to our leading cities. Still the architect finds a very important place in his motives for our hardwoods and for obvious reasons, viz., their superiority for specific purposes over that of iron, steel or stone, and this can best be illustrated in the preference, in large city buildings, warehouses &c., for all kinds of Ironbark posts and beams, flooring, &c., in the interior structure.

Again, the architect is to-day producing some fine architectural conceptions in his bungalow and suburban cottage designs in which our hardwoods are very largely used and with splendid effect. Our red hardwoods in rusticated boards are particularly attractive and handsome. Hardwoods for interior panelling and office furniture have lately come much into vogue and the architect has made a decided success of them, more particularly Mountain "Ash" and Stringybark, which are very effective in office panelling, cabinet work, church furniture such as seats, pulpits, screens, reredos, decorative doors, &c.

In the country the architect still looks, in a great measure, to our hardwoods to supply the necessary material for large structures such as schools, churches, woolsheds, storesheds, and cool storage structures.

Parquetry flooring is particularly effective when made from some of our hardwoods, either in a plain or colour scheme.

BUILDINGS.

The principal hardwoods used in buildings of every variety, from the biggest wool stores, wholesale warehouses, to the smallest cottage residence, are those obtained from the Eucalypts known by their various common names. In the country the timber of the various species is used indiscriminately, the hardest for preference. Ironbark is specified in the largest warehouses and factories for beams, uprights, or storey posts, as iron girders are less reliable in case of fire, when they expand and buckle quickly, thus a collapse of the premises is a grave danger.

The various applications in this connection are mostly given under each species, but the following summary of those which are more generally used may not be out of place :—

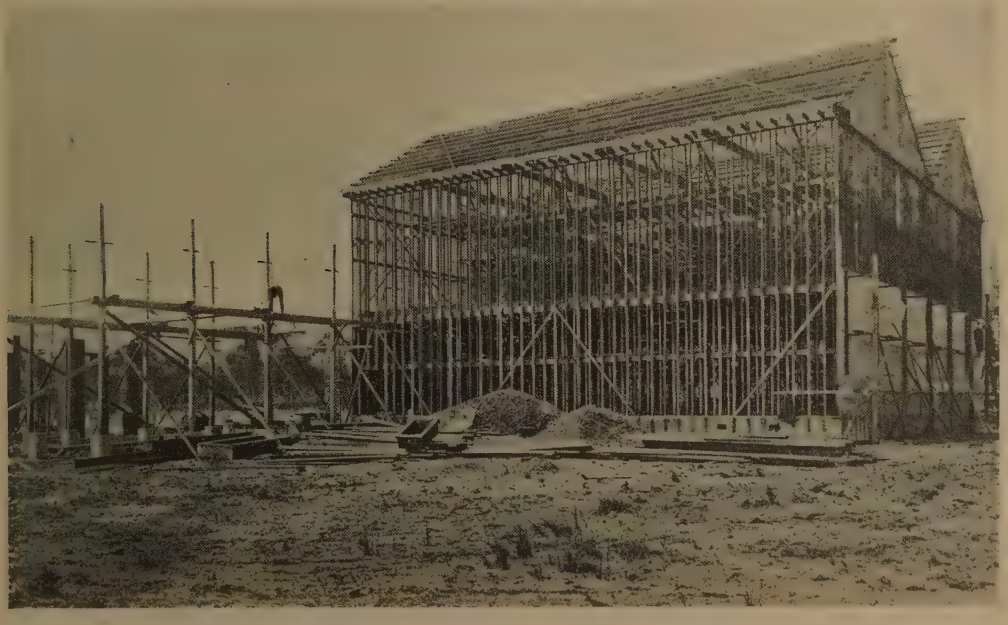
Beams, uprights, bearers, columns—*E. paniculata*, *E. crebra*, *E. siderophloia*, *E. Fergusoni*, *E. Nanglei*. "Ironbarks."

Flooring joists, sills, frames—*E. microcorys*. "Tallow-wood."

Joists, flooring, rafters, studs, plates, bearers—*E. obliqua*, *E. eugenioides*, *E. Muelleriana*, *E. capitellata*, "Stringybarks"; *E. pilularis*, "Blackbutt"; *E. saligna*, "Sydney Blue Gum"; *E. rostrata*, "Murray Red Gum"; *E. tereticornis*, "Forest Red Gum"; *E. propinqua*, "Grey Gum"; *E. maculata*, "Spotted Gum"; *E. microcorys*, "Tallow-wood."

Joists, flooring, rafters, studs, plates—*E. Delegatensis*, *E. Sieberiana*, *E. fraxinoides*, "Ashes"; *E. marginata*, "Jarrah"; *E. resinifera*, "Forest Mahogany"; *E. acmenioides*, *E. umbra*, "White Mahogany."

FIG. CI



Burnie Freezing Works, Tasmania; built of *Eucalyptus Delegatensis*.

FIG. CII.

Sandgate Railway Station, Queensland; built of Hardwood.

FIG. CIII.

Mundubbera Railway Station, Queensland; built of Hardwood.

FIG. CIV.

A Western Australia house; built of hardwood.

FIG. CV.

Photo.] Bungalow built of hardwood. New South Wales. [*T. P. Sampson*

FIG CVI.

Weatherboard house built of hardwood. Queensland.

FIG. CVII.

Photo.] Rusticated Hardwood Cottage. New South Wales. [*F. B. Shambler*

FIG. CVIII.

Hardwood Weatherboard Church. Victoria.

FIG. CIX.

Photo.] [*J. W. Tremain.*

Fluted Ironbark columns. Camden House, N.S.W.

INTERIOR FITTINGS.

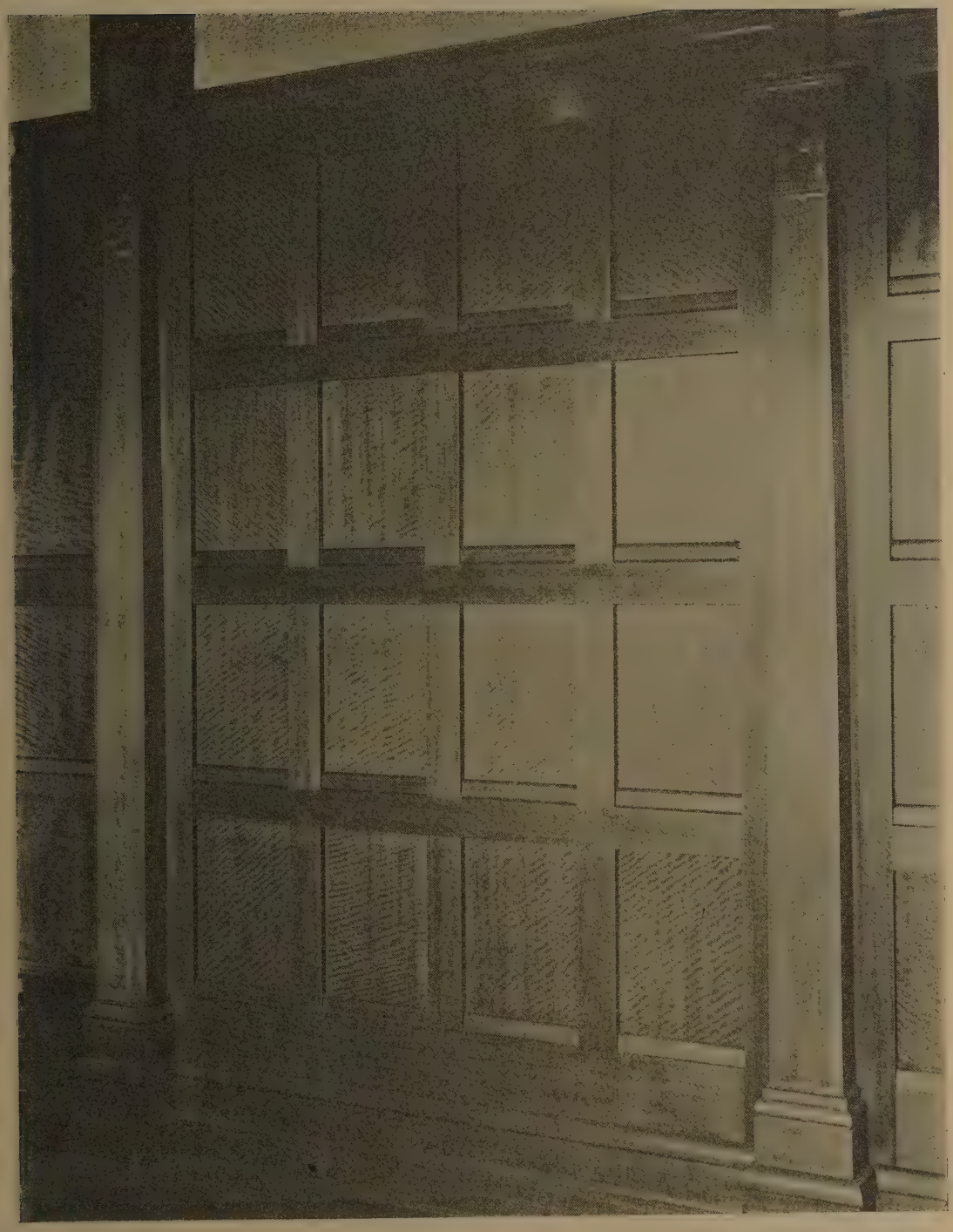
From the very foundation of the colony our softwoods were utilised for interior decoration of public and private buildings, &c., but it is only within the last few years these have given place to hardwoods, a change which is at the present time much in favour. These hardwoods, differing in colour and figure from any imported timber, particularly lend themselves to every branch of architecture, and by a judicious arrangement of straight and figured grain a very beautiful and novel effect can be produced. The pale-coloured timbers look perhaps best wax polished, only a few species are at present used, but almost any of the Eucalypts give good results for this purpose by careful selection of the particular grain and colour required. For variety, our hardwoods contain an almost unlimited field for this particular purpose, and there is no doubt that greater and still better effects will be obtained when our timbers are more fully known and better appreciated.

The interiors shown under the different illustrations will give some idea of the richness of figure and grain of the timbers so employed, whilst the colour is depicted in the chromatic plates of these species.

FIG. CX.

Stringybark Panels with Satinwood figure. John Danks and Son, Melbourne, Victoria. (Similar figuring is found in most Eucalypt timbers.)

FIG. CXI.



Stringybark panels with Fiddleback figure. John Danks and Son, Melbourne, Victoria.
(This figure is by no means unusual amongst Australian Hardwoods.)

FIG. CXII.

Stringybark panelling and clock. John Danks and Son, Melbourne, Victoria.

FIG. CXIII.

Blackwood Panelling. Commonwealth Bank, Sydney.

FIG. CXIV.

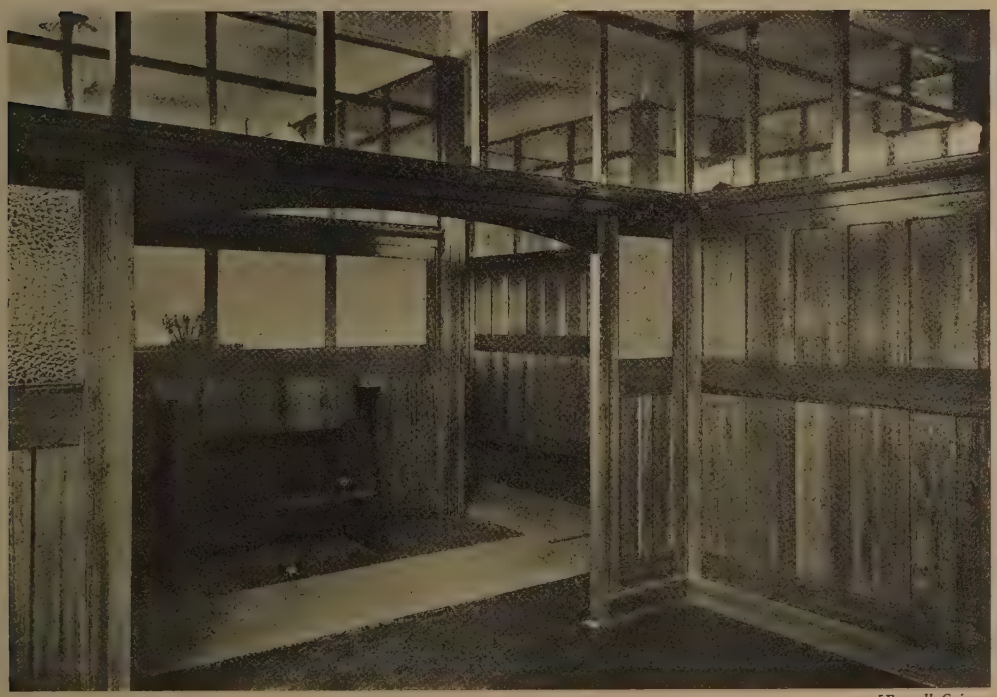


Photo.] [*Russell Grimwade.*

Stringybark fittings and floor. Australian Glass Co., Spottiswood, Victoria.

58699—2 D

FIG CXV.

Jarrah fittings and furniture. Western Australia.

FIG. CXVI.

Jarrah fittings and furniture. Bank, Western Australia.

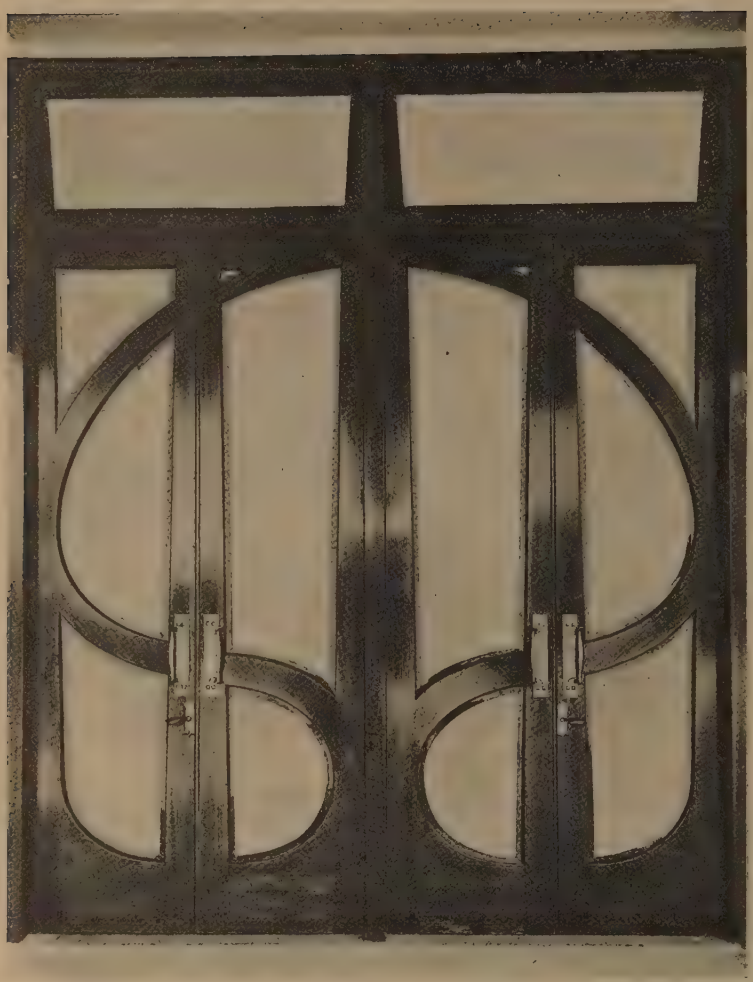
FIG. CXVII.

Figured Stringybark Fittings. Tasmania.

FIG. CXVIII.

Photo] Church furniture made of Victorian Stringybark. *North & Williams.*

Fig. CXIX.



Mountain Ash door. Pengelley & Co., Adelaide.

Fig. CXX.

Mountain Ash door.

FURNITURE.

A few years ago it is doubtful if any one would have associated our hardwoods with the furniture trade, and yet to-day, although of course softwoods constitute a very large fraction of cabinet making, hardwoods are coming to the front in this industry.

Quite recently an important trade has sprung up in the utilization of our Eucalyptus hardwoods for furniture, and no more decorative and charming timbers can be found anywhere.

A few illustrations are given of the unique figuring of our hardwoods, especially the Eucalypts, and the difficulty of weight has been overcome by veneering.

It is strange, but nevertheless true, that some of the most despised timbers, such as Stringybarks, are now found to be as handsome in figure as any previously used decorative woods, and are deserving of a better appreciation in other economic directions than has been given them in the past.

I hold a brief for the once despised Stringybarks as an excellent all round timber, for it has great qualities in colour, weight, strength, durability, and for its future afforestation in worthless ridges and lands.

The suitability of our hardwoods for this special trade is fully demonstrated by the coloured illustrations, the data given under each species, and the black and white plates, showing their technology.

FIG. CXXI.

Jarrah bedroom suite. Western Australia.

FIG. CXXII.

Photo.] Stringybark chairs. Murray Red Gum table, Adelaide. [*Walter Gill*

FIG. CXXIII.

York Gum wardrobe. Western Australia.

FIG. CXXIV.

Blackwood. H. Goldman & Co., Melbourne, Victoria.

FIG. CXXV.

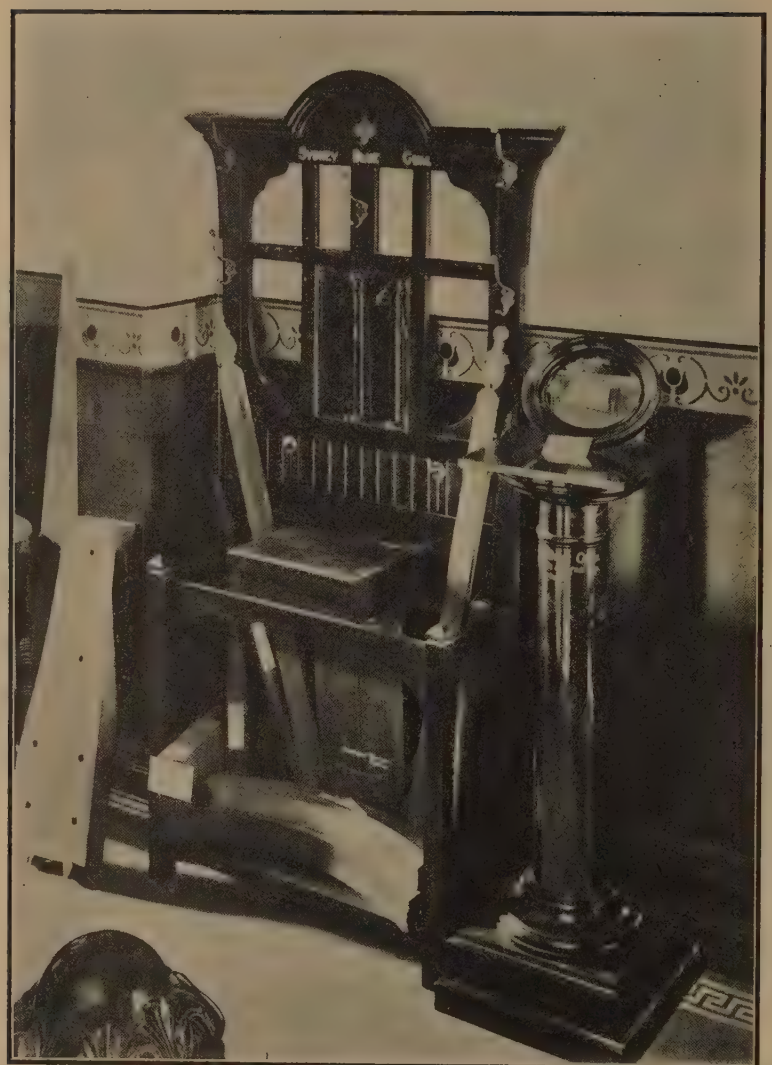


Photo.] [*T. C. Roughley.*

Hall stand, column, picture frame, fencing pickets, felloes, pick handles, railway waggon sole bar; all made of Sydney Blue Gum, *E. saligna*.

FIG. CXXVI.

Stringybark and Blackbutt chairs. Designed by His Excellency the Governor-General of Australia, Sir Ronald Munro Ferguson, P.C., G.C.M.G.

FIG. CXXVII.

Spotted Gum.

PARQUETRY.

The hardwoods of Australia are particularly suited for this purpose, and their application can be seen in several public and private institutions throughout Australia, Eucalyptus timbers being preferred, such as *E. resinfera*, *E. maculata*. *E. microcorys*, *E. acmenioides*, *E. pilularis*, *E. marginata*, although many others are just as suitable.

SHINGLES AND FENCING.

Our Casuarinas (Shee Oaks) have been the source of supply for shingles since the foundation of the colony, as they possess two important features which make them eminently suitable for this trade, *i.e.*, durability and fissibility. The timber now used is imported from America, a Redwood of a very soft nature.

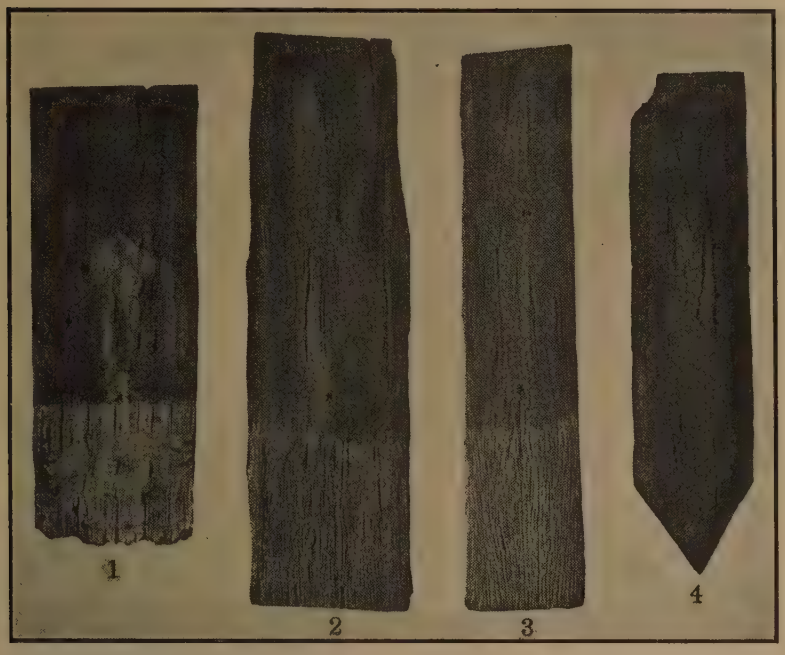
For fencing, any of our hardwoods are satisfactory, and so are employed for this purpose. It is in this form that the highly decorative qualities of our hardwoods can be seen, and after a short weathering some of the finest figuring is plainly visible on any common back fence. *Vide* Figs. IV and V.

Some pretty front fences of hardwood are to be seen in the suburbs of most of the large towns.

FIG. CXXVIII.

Jarrah shingles, Roof of Town Hall Perth, Western Australia.

FIG. CXXIX.



1. Shingle, Forest Oak, *Casuarina torulosa*, AIT. Taken from roof of a Bronte House," Waverley; in use seventy years.

2 and 3. Ironbark Shingles, *Eucalyptus siderophloia*. Taken from Church of England, Narellan,; in use over 40 years.

4. Forest Oak Shingle, *Casuarina torulosa*, AIT. One of the original shingles from Christchurch Steeple, George-street, Sydney. Shingled in 1854.

FIG. CXXX.

1. Ironbark Post, *Eucalyptus crebra*. In the ground eighty-five years. Putty, near Singleton, N.S.W.

2. White Stringybark Post, *Eucalyptus eugenioides*. SIEB. Sixty years in the ground, Barker's Creek, N.S.W.

3. Ironbark stakes, in use for forty-seven years. Gamboola, Molong, N.S.W.

SHIP-BUILDING.

It is sometimes thought that the days for wooden vessels of large size are over, but a recrudence of their construction occurs periodically, and in the war days (1914-1918) many wooden keels were laid down. Timber still enters very largely into the construction of ferry boats, small coasting vessels, yachts, and watermen's boats.

For interior fittings of passenger ocean boats wood is extensively used, especially as it is so decorative, but principally softwoods.

In the case of the former, hardwoods enter largely in the construction, and these are all cut to shape (not bent), and any kind of sound hardwood is used. For keelsons, rudder posts, keels, "Grey Ironbark," *Eucalyptus paniculata,* is preferred, whilst Colonial "Teak" *Flindersia australis,* is employed for stern posts. For planking, "Spotted Gum," *Eucalyptus maculata,* is used below the water-line owing to its flexibility, as it can be bent into shape easier than any other hardwoods, and above the water-line Kauri is substituted. Strange to say no particular attention appears to be paid to seasoning before use, except for special purposes.

Whenever strength is required, "Grey Ironbark" is chosen over other Ironbark timbers.

The following is a description of the hardwood timbers used in the construction of the cargo coaster, T.S.S. "Wallamba," recently built at Forster, Cape Hawke:—

"Turpentine planking, the dimensions of which are 9 inches by 3 inches, is used solely below the water-line, on account of its cobra resisting properties. Blue Gum and Spotted Gum are the timbers used in the general structure above the water-line. The belting consists of Brush Box, the reason being that this timber wears gradually without splintering. Because of the splendid qualities of Ironbark, this timber is used exclusively in the internal girders. The knees consist of Tea Tree, preferably Prickly Tea Tree if this can be procured sufficiently large. The decking consists of Flooded Gum and Blue Gum, of which the former predominates. These timbers have been substituted for Oregon in anticipation of the regular carriage of deck cargo.

"The boat has a gross tonnage of 350 tons and a draft of only 6 or 7 feet."

The following timbers are recommended in connection with this industry, some having already been used for this purpose:—

Botanical Name.	Common Name.
BEARINGS—UNDER-WATER.	
Flindersia australis	Teak.
Eucalyptus paniculata	Grey Ironbark.
E. siderophloia	Red Ironbark.
E. microcorys...	Tallow-wood.
E. intermedia	Bloodwood.
BLOCKS.	
Acacia melanoxylon	Blackwood.
BOOMS.	
Same as Spars and Masts.	

Botanical Name.	Common Name.
DECKING.	
Gmelina Leichhardtii	... *Beech.
Agathis robusta	... *Queensland Kauri.
FLOORING.	
Eucalyptus obliqua	... Stringybark.
Araucaria Cunninghamii	... *Hoop Pine.
Podocarpus elata	... *Brown Pine.
FURNITURE.	
Dysoxylon Muelleri	... *Red Bean.
D. Fraserianum	... *Rosewood.
Flindersia Chatawaiana	... *Queensland Maple.
Elæocarpus grandis	... *Blue Fig.
Alphitonia excelsa	... Red Ash.
Castanospermum australe	... Black Bean.
Acacia melanoxylon	... Blackwood.
Cryptocarya Palmerstoni	... Queensland Walnut.
Orites excelsa	... *Silky Oak.
Banksia integrifolia	... *White Honeysuckle.
B. serrata	... *Red Honeysuckle.
Stenocarpus sinuatus	... *Fire Tree.
Fagus Cunninghamii	... *Tasmanian Myrtle.
Agathis robusta	... *Queensland Kauri.
Araucaria Cunninghamii	... *Hoop Pine.
Podocarpus elata	... *Brown Pine.
P. pedunculata	... *Queensland Black Pine.
GRATINGS.	
Geissois Benthami	... *Red Carabeen.
Weinmannia lachnocarpa	... Marari e.
Sloanea Woollsii	... *Yellow Carabeen.
Flindersia Schottiana	... *Cudgerie.
Melaleuca Maideni	... Tea Tree.
Eucalyptus oreades	... Mountain Ash.
E. Delegatensis	... A Mountain Ash.
Gmelina Leichhardtii	... *Beech.
Orites excelsa	... *Silky Oak.
Avicennia officinalis	... Grey Mangrove.
GUNWALES.	
Ceratopetalum apetalum	... *Coach-wood.
Eucalyptus maculata	... Spotted Gum.
E. Delegatensis	... Mountain Ash.
E. fraxinoides	... White Ash.
E. saligna	... Blue Gum.
E. globulus	... Blue Gum.
Orites excelsa	... *Silky Oak.
Diospyros pentamera	... Grey Plum.
HANDLES FOR BOAT HOOKS.	
Ceratopetalum apetalum	... *Coach-wood.
Eucalyptus Delegatensis	... A Mountain Ash.
E. oreades	... Mountain Ash.
E. fraxinoides	... White Ash.
INSULATORS.	
Flindersia australis	... Native Teak.
Acacia Cambagei	... Gidgea.
A. pendula	... Myall.
A. harpophylla	... Brigalow.
JOINERY.	
Geissois Benthami	... *Red Carabeen.
Echinocarpus australis	... *Maiden's Blush.
Sloanea Woollsii	... *Yellow Carabeen.
Dysoxylon Muelleri	... *Red Bean.
D. Fraserianum	... *Rosewood.
Flindersia Chatawaiana	... *Queensland Maple.
Cedrela Toona	... *Cedar.
Acacia melanoxylon	... Blackwood.
Castanospermum australe	... Black Bean.
Agathis robusta	... *Queensland Kauri.
Araucaria Cunninghamii	... *Hoop Pine.

* Softwoods

Botanical Name.	Common Name.
KEELS, STEM AND STERN POSTS.	
Flindersia australis	Teak.
Eucalyptus paniculata	Grey Ironbark.
E. microcorys	Tallow-wood.
E. maculata	Spotted Gum.
E. saligna	Blue Gum.
E. gomphocephala	Tuart.
KNEES.	
Melaleuca Smithii	Tea Tree.
M. Maideni	Tea Tree.
Avicennia officinalis	Grey Mangrove.
Banksia integrifolia	*White Honeysuckle.
B. serrata	*Red Honeysuckle.
MASTS.	
Same as Spars and Masts.	
OARS.	
Eucalyptus Delegatensis	Mountain Ash,
E. viminalis	Ribbony Gum.
E. rubida	Mountain Gum.
PATTERN MAKING.	
Geissois Benthami	*Red Carabeen.
Echinocarpus australis	*Maiden's Blush.
Tetranthera reticulata	*She Beech.
Fagus Cunninghamii	*Tasmanian Myrtle.
Gmelina Leichhardtii	*Beech.
Callitris Macleayana	*Stringybark Pine.
Podocarpus elata	*Brown Pine.
P. pedunculata	*Queensland Black Pine.
PLANKS.	
Ceratopetalum apetalum	*Coach-wood.
Geissois Benthami	*Red Carabeen.
Echinocarpus australis	*Maiden's Blush.
Elæocarpus grandis	*Blue Fig.
Flindersia Schottiana	*Cudgerie.
F. Oxleyana	Long Jack.
Cedrela Toona	*Red Cedar.
Eucalyptus fraxinoides	White Ash.
E. Delegatensis	A Mountain Ash.
E. maculata	Spotted Gum.
E. pilularis	Blackbutt.
E. eugenioides	White Stringybark.
E. Australiana	Narrow-leaved Peppermint.
E. regnans	Giant Gum.
E. marginata	Jarrah.
E. diversicolor	Karri.
E. tereticornis	Forest Red Gum.
E. saligna	Sydney Blue Gum.
E. botryoides	Bangalay.
E resinifera	Forest Mahogany.
E. acmenioides	White Mahogany.
Dacrydium Franklini	*Huon Pine.
Podocarpus pedunculata	*Queensland Black Pine.
RIBS OR TIMBERS, BENT.	
†Ceratopetalum apetalum	*Coach-wood.
Acacia melanoxylon	Blackwood.
Eucalyptus Delegatensis	Mountain Ash.
E. globulus	Blue Gum or Eurabbie.
E. maculata	Spotted Gum.
Melaleuca Smithii	Tea Tree.

*Softwoods.

† Mr. C. Still informs me that he has used this timber for ribs in a boat which was exposed to all weathers for seven or eight years, and they were quite sound when broken up after that time.

Botanical Name.	Common Name.
RUDDERS.	
Dysoxylon Fraserianum	*Rosewood.
D. Muelleri	*Red Bean.
Cedrela Toona	*Cedar.
Flindersia Chatawaiana	*Queensland Maple.
Elæocarpus grandis	*Blue Fig.
Agathis robusta	*Queensland Kauri.
Podocarpus elata	*Brown Pine.
P. pedunculata	*Queensland Black Pine.
SPARS AND MASTS.	
Ceratopetalum apetalum	*Coach-wood.
Eucalyptus fraxinoides	White Ash.
E. oreades	Mountain Ash.
E. Delegatensis	A Mountain Ash.
STERN OR TUCK.	
Cedrela Toona	*Cedar.
Acacia melanoxylon	Blackwood.
Flindersia Chatawaiana	*Queensland Maple.
Eucalyptus saligna	Blue Gum.
Orites excelsa	*Silky Oak.
Fagus Cunninghamii	*Tasmanian Myrtle.
TARGETS.	
Eucalyptus oreades	Mountain Ash.
E. Delegatensis	A Mountain Ash.
	*Any of the Pines.
***WEDGES (Launching).**	
Tristania conferta	Brush Box.
T. laurina	Water Gum.
Eucalyptus Fletcheri	River Box.
Melaleuca Smithii	Broad-leaved Tea Tree.
Eucalyptus hemiphloia	Grey Box.
Flindersia Oxleyana	Long Jack.
Eucalyptus melliodora	Yellow Box.
YARDS.	
Same as Spars and Masts.	

In order of testing results.

*** These tests were made by Mr. J. J. King-Salter, Manager, and Mr. J. W. Clark, Assistant Manager, H.M.A. Dockyard, Cockatoo Island, Sydney.**

Fig. CXXXI.

First Shipbuilding Dockyard in Australia. Dawes Point, Sydney Cove. 1800.

FIG. CXXXII.

Launching of the ketch "Relic," at Jervis Bay, New South Wales, 1903. Built of Blackbutt, Bloodwood, Mahogany, Spotted Gum, Bangalay, and Stringybark.

FIG. CXXXIII

Schooner built of Jarrah. Geraldton, Western Australia.

FIG. CXXXIV.

Brigantine "Alto," built of Jarrah. Western Australia.

FIG. CXXXV.

Jarrah-built pearling luggers at Broome, Western Australia.

FIG. CXXXVI.

Cargo steamer, built of local Hardwoods (see letterpress) at Tuncurry, N.S.W., by Messrs. Allen Taylor & Co., for Sydney trade.

FIG. CXXXVII.

Stern of cargo steamer, built of local Hardwoods at Tuncurry, N.S.W., by Messrs. Allen Taylor & Co.

FIG. CXXXVIII.

Schooner "Makoe," built in Sydney Harbour; keel and sternpost of Ironbark, and other parts of general Hardwoods; knees of Tea-tree.

FIG. CXXXIX.

Trawler built in Sydney Harbour of general Hardwoods.

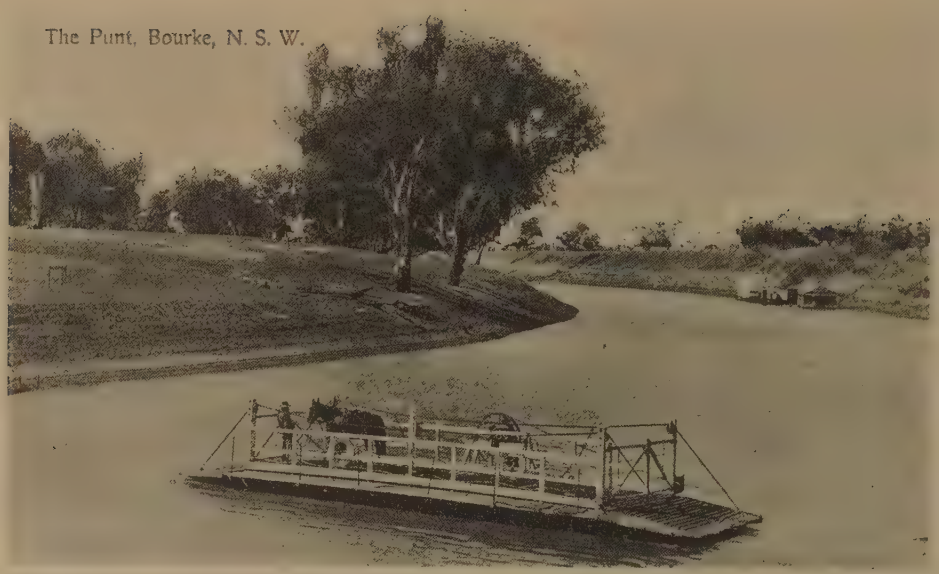
FIG. CXL.

Trawler built of Ironbark and general Hardwoods; knees of Tea-tree.

FIG. CXLI.

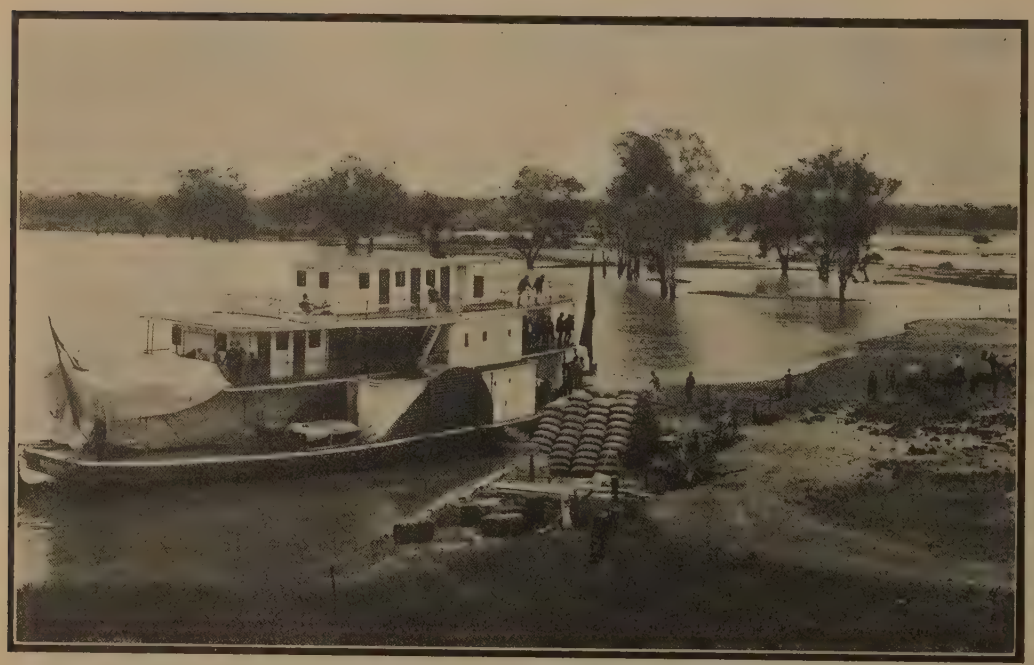
Spotted Gum and Stringybark pontoon.

FIG. CXLII.



Punt in Darling River (Bourke); built of local Hardwoods.

FIG. CXLIII.



A River Murray boat, built of Murray River Red Gum.

CARRIAGE BUILDING.

Under this heading the trade includes the various branches such as :—Railway carriages (both goods and passenger), tram cars, lorries, vans, trade carts, buggies, road coaches and sulkies. Hardwoods enter very largely into the manufacture of these, especially in the railway workshops and heavy wool waggon factories, strength and durability of course being a *sine qua non.* The following are the principal ones used, but many more of our hardwoods are equally suitable :—

Botanical Name.	Common Name.
BUGGIES.	
Eucalyptus maculata	Spotted Gum.
E. saligna	Sydney Blue Gum.
E. marginata	Jarrah.
E. eugenioides	White Stringybark.
E. Delegatensis	Mountain Ash.
E. obliqua	A Stringybark.
FELLOES.	
Eucalyptus saligna	Sydney Blue Gum.
E. diversicolor	Karri.
E. loxophleba	York Gum.
HUBS OR NAVES.	
Eucalyptus paniculata	Grey Ironbark.
E. siderophloia	Broad-leaved Red Ironbark.
E. crebra	Narrow-leaved Red Ironbark.
E. microcorys...	Tallow-wood.
E. maculata	Spotted Gum.
E. calophylla	Red Gum.
E. redunca	Wandoo.
E. loxophleba...	York Gum.
INTERIOR DECORATIONS.	
Eucalyptus maculata	Spotted Gum.
E. marginata	Jarrah.
E. Delegatensis	Mountain Ash.
E. obliqua	Stringybark.
Acacia melanoxylon	Blackwood.
Stenocarpus salignus	Beefwood.
Flindersia Oxleyana	Long Jack.
RAILWAY CARRIAGE FRAMES AND GOODS VANS.	
Eucalyptus microcorys...	Tallow-wood.
E. paniculata	Grey Ironbark.
E. siderophloia	Broad-leaved Red Ironbark.
E. crebra	Narrow-leaved Red Ironbark.
E. gomphocephala	Tuart.
E. maculata	Spotted Gum.
E. pilularis	Blackbutt.
Flindersia australis	Teak.
SHAFTS.	
Eucalyptus maculata	Spotted Gum.
E. microcorys...	Tallow-wood.
E. calophylla	Red Gum.
E. Delegatensis	Mountain Ash.
E. oreades	Mountain Ash.
E. eugenioides	White Stringybark.
E. obliqua	A Stringybark.
E. diversicolor.	Karri.
Flindersia Oxleyana	Long Jack.
SPOKES.	
Eucalyptus paniculata	Grey Ironbark.
E. siderophloia	Broad-leaved Red Ironbark.
E. crebra	Narrow-leaved Red Ironbark.
E. diversicolor	Karri.
E. microcorys...	Tallow-wood.
E. calophylla	Red Gum.
E. Delegatensis	Mountain Ash.
E. oreades	Mountain Ash.
E. maculata	Spotted Gum.
E. eugenioides	White Stringybark.
WOOL LORRIES.	
(See Carriage Frames.)	

FIG. CXLIV.

State Governor's Car, N.S.W. Government Railways. Frame built of Tallow-wood, Spotted Gum, and Ironbark.

FIG. CXLV.

Spotted Gum framing and fittings. Smoking-room, State Governor's Carriage, N.S.W. Government Railways.

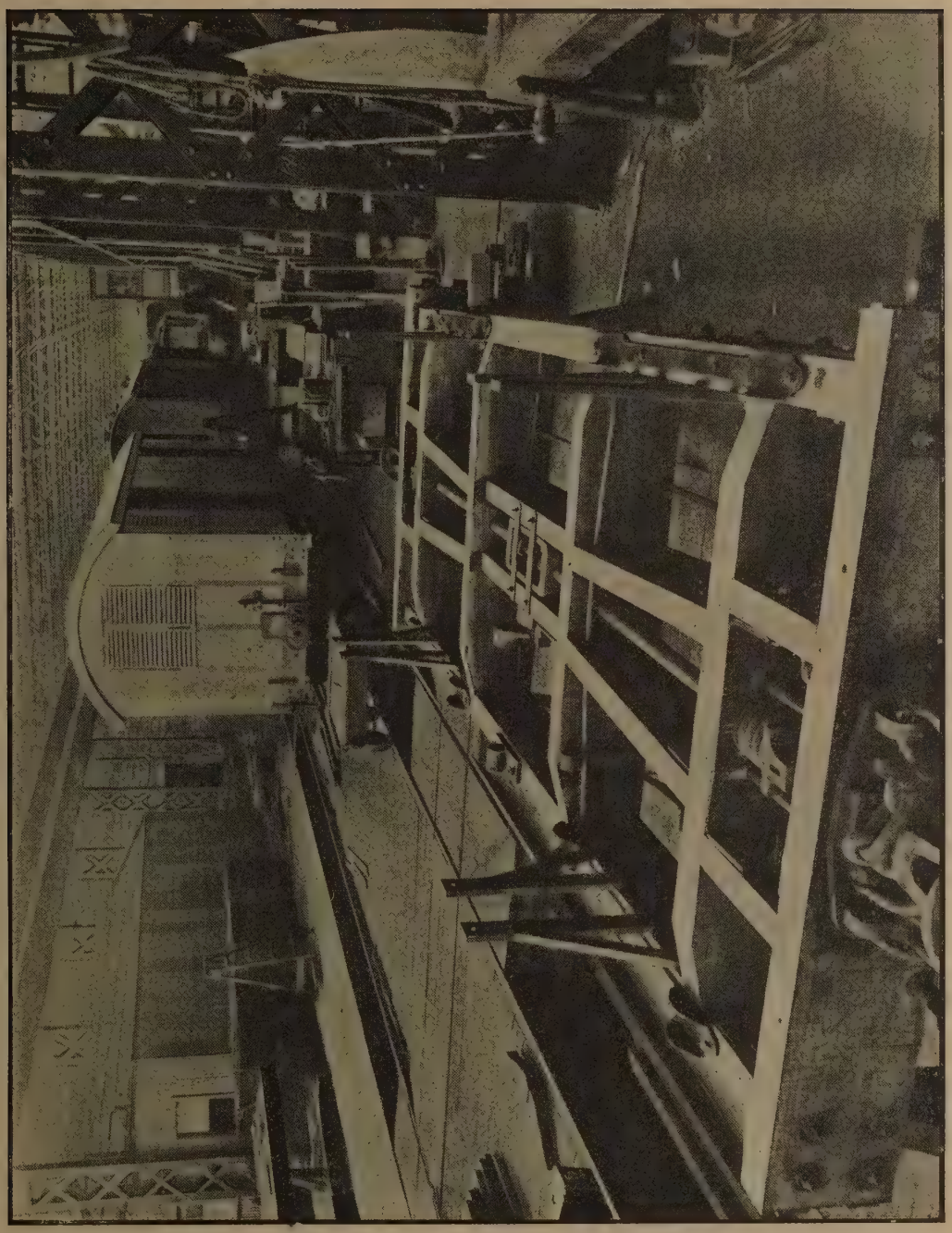


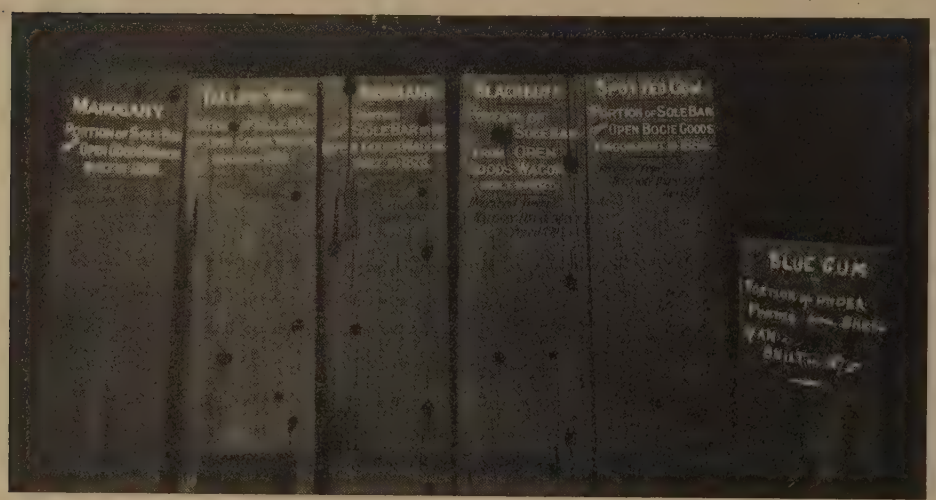
Fig. CXLVI.

Wandoo and Tuart under-carriage frame. Western Australia.

FIG. CXLVII

Ironbark, Blue Gum, and Spotted Gum. "K" waggon. Queensland.

FIG. CXLVIII.



Timbers which have been used in N.S.W. Government railway carriages.

FIG. CXLIX.

Ironbark, Spotted Gum, Tallow-wood table-top wool waggon, to carry 28 tons.
New South Wales.

FIG. CL.

Ironbark, Spotted Gum, and Tallow-wood wheat waggon. New South Wales.

COOPERAGE.

The timber mostly employed now is Danzig Oak, but a field of investigation exists regarding the suitability of our own timbers for casks. Silky Oak has been used to some extent and gives satisfaction, but scarcity of material has somewhat marred its extensive use in this trade.

A prime necessity exists for the discovery of a good Australian timber for the manufacture of casks, the best so far is Blackwood, *Acacia melanoxylon*.

In this connection, the Australian Eucalyptus Ashes are recommended for trial, such as *E. fraxinoides, E. Delegatensis, E. oreades, E. regnans, E. maculata, E. viminalis, E. rubida,* and the best of the stringybarks.

DESTRUCTIVE DISTILLATION.

The scientific pioneers of this industry in Australia is the firm of Cuming, Smith & Co., of Melbourne, who have erected large plants in Victoria, and for several years have now been working on such hardwoods as *E. regnans*, *E. obliqua*, and other light-coloured timbers growing in the district. Large quantities are treated, and the firm is now placing on the market the following products :—

Wood Tar. Crude Tar Oil.
Tar Oil for Paint. Wood Pitch.
Tar Spirit.

Pyroligneous Acid—Contains acetic acid, methyl-alcohol, a little acetone and numerous other substances in small amounts.

Acetic Acid—Used for manufacture of wood vinegar, formation of acetates, formation of acetate of lime for manufacture of acetone, and for numerous other purposes, particularly in the dye industry.

Crude Methyl-alcohol
Semi-refined Methyl-alcohol
Pure ,, ,,
Refined ,, ,,
} Used for denaturing ordinary spirit, much used in the colour industry for dyes; when oxidised these form formalin or formaldehyde.

Formalin—Made from the methyl-alcohol.

Denaturing Spirit—Crude methyl-alcohol from the pyroligneous acid, it contains numerous bodies objectionable to the taste.

Acetate of Lime—Used for making acetone by dry distillation.

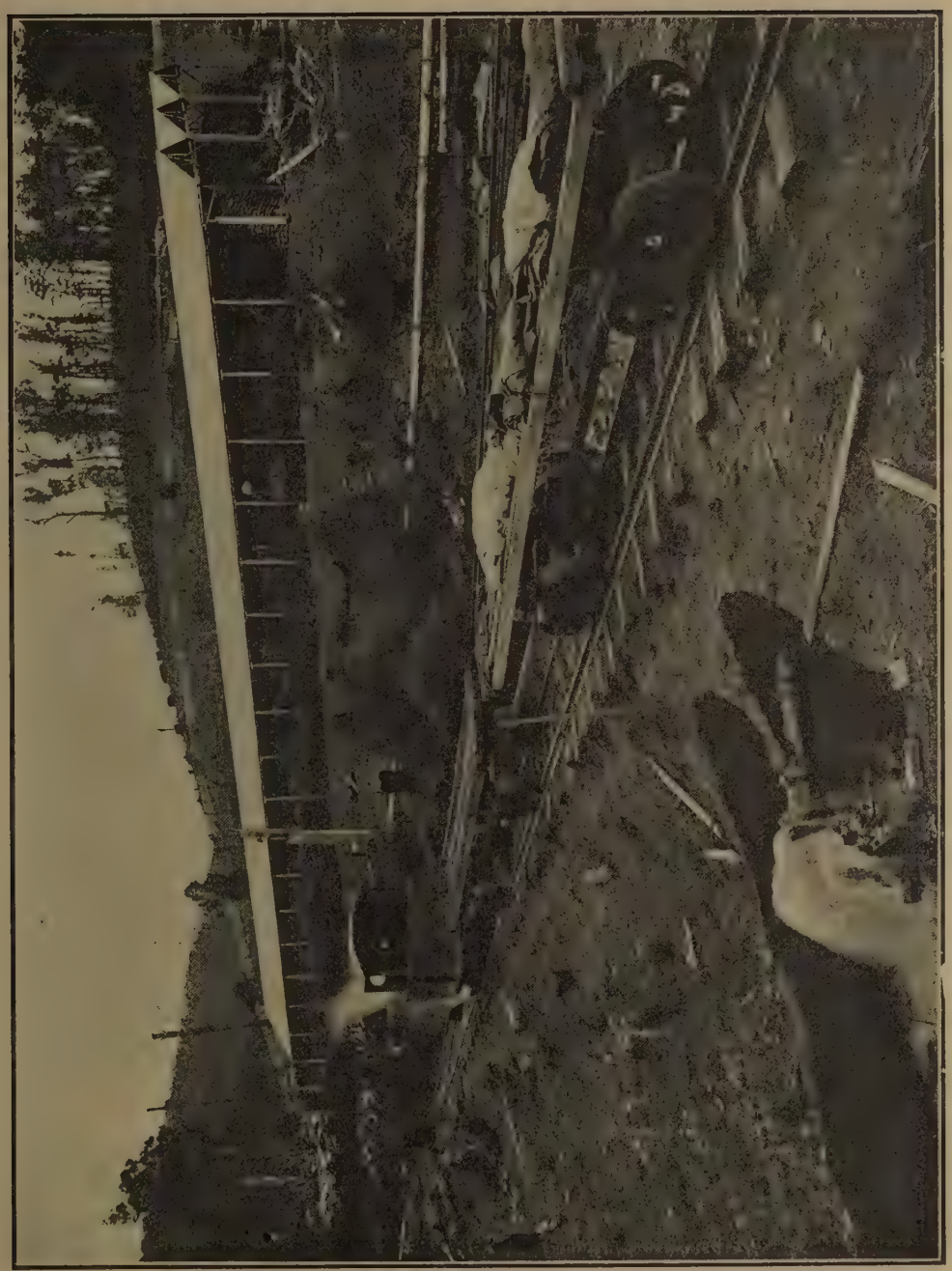
Acetone Oil—Derived from the acetate of lime by dry distillation.

Semi-refined Acetone
85 per cent. ,,
Pure ,,
Refined ,,
} Acetone is a valuable product for the manufacture of chloroform, iodoform, celluloid and synthetic drugs. Its chief use is a solvent for nitrocellulose in the manufacture of smokeless powder.

Ethyl Methyl Katone.

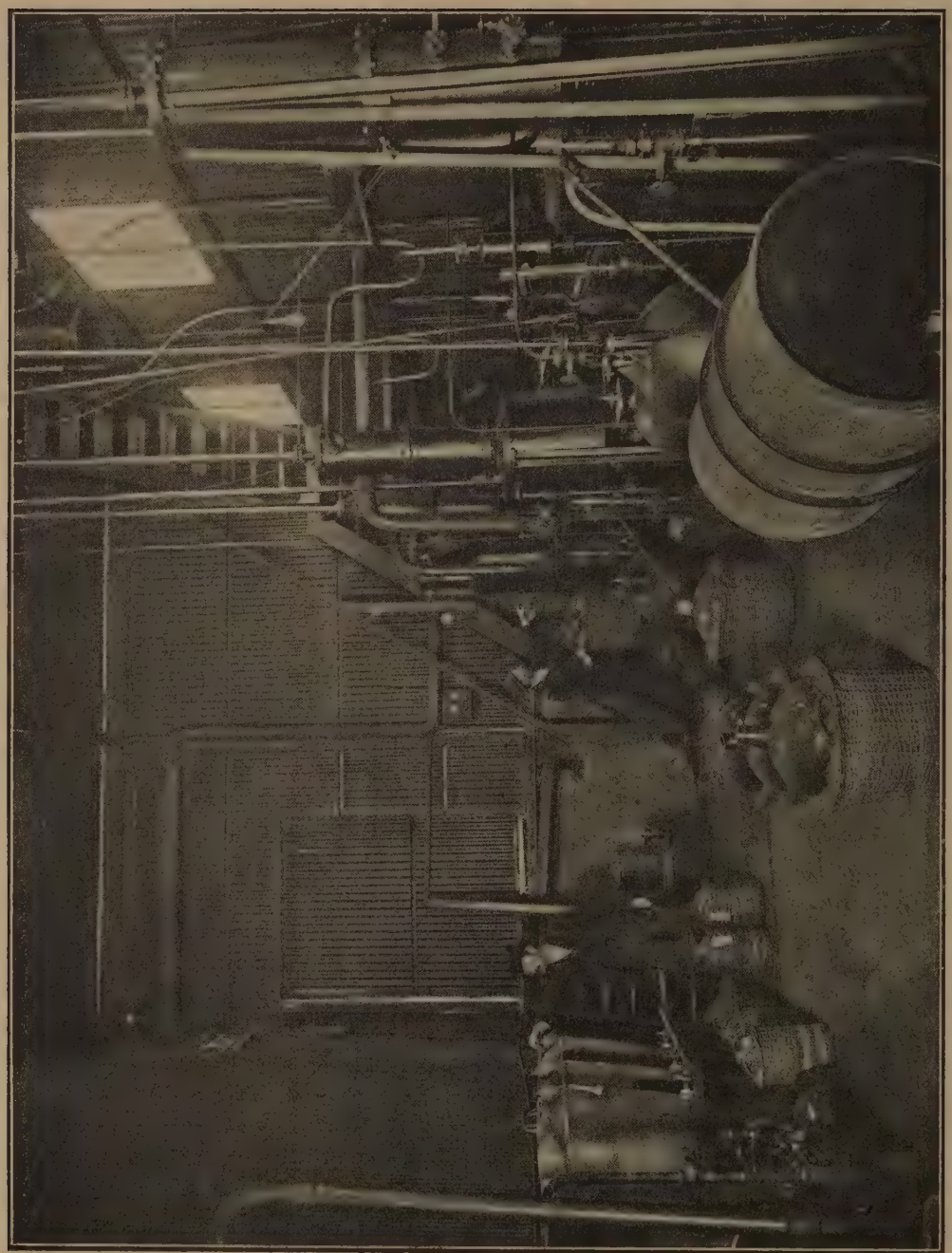
The demand for charcoal having considerably increased since the recent development of gas-suction engines, this is now being produced in several States, but in almost every instance only the charcoal is saved, all the other products being allowed to go to waste, a proceeding which should be stopped by legislation, as the loss of so many valuable products is little short of criminal.

FIG. CLI.



Drying Shed. Destructive distillation of Hardwoods by Messrs. Cuming, Smith, & Co., at Warburton, Yarra Junction, Victoria.

FIG CLII.



Formalin plant. Destructive distillation of Hardwoods by Messrs. Cuming, Smith, & Co., Warburton, Yarra Junction, Victoria.

FIG. CLIII.

Methyl Alcohol Still. Destructive distillation of Hardwoods by Messrs. Cuming, Smith, & Co., Warburton, Yarra Junction, Victoria.

CHARCOAL.

A great demand for this commodity sprang up recently in Australia, as stated above, and in Victoria whole country sides are being cleared of standing Eucalyptus timber for the manufacture of charcoal, all being taken irrespective of species, although those of a pale colour are reputed to give the best charcoal. Unfortunately, with one or two exceptions, in the production of this commodity the valuable by-products of the timber go to waste.

FIG. CLIV

Destructive distillation of Hardwoods; charcoal in bags in the foreground. Messrs. Cuming, Smith, & Co.'s Plant, Yarra Junction, Victoria.

FIG. CLIV.

FIG. CLV.

Bush plant for producing Charcoal. All other products being wasted or lost.

ENGINEERING TIMBERS.

Of the many utilisations of our hardwoods, not the least of industrial importance is their special adaptability for engineering purposes. The *sine qua non* for timbers of this class are, first and foremost, strength, durability, hardness—qualities which are found in so many individual species of our abundant hardwoods.

Australia might truly be said to be the home of hardwoods, as the Genus Eucalyptus, with its numerous species, covers still many millions of acres, especially in the mountain ranges and gullies. The Mallee species in the interior, being too small to yield a useful timber, are naturally outside the scope of this work. A journey in almost any part of the continent will show Eucalyptus forests in various stages of growth.

The gradual depleting of the best timber-yielding species has caused the engineer to look to what has been regarded formerly as secondary woods, but these are by no means to be despised, and so the exhaustion of our hardwoods is far from being complete.

Previously, timbers regarded locally as inferior have been found by experience to be admirably suited for engineering works, and there is yet much to learn regarding the durability of our respective hardwoods; some of the hardest are not necessarily the most durable, as for instance, Penda, *Xanthostemon oppositifolius*, Queensland. This wood is of an exceptionally hard nature, yet it is stated to be the least durable of any of the hardwoods in bridge work, for in this connection Mr. W. D. Francis, of Queensland, writes me :—

> *Xanthostemon oppositifolius*, very popularly known as "Penda" is not widely distributed, being probably confined to this and a few districts immediately surrounding it. In the localities where it is found it is very abundant, developing into large trees about 120 feet in height, and up to 4 or 5 feet in trunk diameter. The timber is remarkably hard, harder in fact than that of any of the Eucalypts I have observed. In the footnote to the description in the Queensland Flora, Vol. II, p. 642, a Mr. Luya is quoted as stating that the timber is "indestructible except by fire . . . ." After some seven years experience in a locality where the tree is especially abundant, I cannot confirm Mr. Luya's comprehensive assertions as to the durability of the timber and its suitability for purposes where it is in contact with the ground. As bridgework is mentioned by Mr. Luya as a department where it could be employed, I shall inform you of an experience in that particular connection where the use of the timber for bridge building resulted in its failure to last, and caused the local authority considerable expense in replacing it with durable material. When this district was opened up some eight or nine years ago, the Department of Lands made a road into it. As the country was almost entirely of dense scrub where hardwood was absent, "Penda" being a very hard timber, was used for the bridges. Within the past three years it has been found necessary to replace all of them with durable structures. Besides these evidences of its lack of durability in contact with the ground, we have had several experiences with similar results around our home. But where it is susceptible to decay in the ground, it is probably a very good timber to last under other conditions, and there are, perhaps, several economic uses where the timber with its remarkable properties could be employed with advantage.

The importance of durability will often outweigh the character of strength in the selection of a timber by an engineer when considering cost, thus *Eucalyptus eugenioides*, White Stringybark, and *Eucalyptus pilularis*, Blackbutt, are durable timbers, and often used in substitution for others possessing much greater strength.

In a general way it may be stated that the cases in which our hardwoods cannot be utilised by the engineer are almost negligible.

The following headings have been selected under which to arrange some of the suitable hardwoods utilised for engineering purposes :—

BRIDGES.

Naturally, in a commercially new country plentifully supplied with native hardwoods, the erection of bridges has been a great factor in the opening up of, and settlement upon, the land, and as iron structures are not always obtainable, timber has been extensively drawn upon.

No specific timber has had a monopoly throughout Australia for bridge construction, but each State has utilised the hardest, most durable, and best fitted for the purpose to be found in the respective State. Thus, in New South Wales, preference is given to Ironbarks for piles, longitudinal girders, transoms, and braces ; and Tallow-wood and Brush Box for decking, kerbing, and girders ; but many other hardwoods are used for these various parts when those particular timbers are not available. In Western Australia, naturally, one finds Karri or Jarrah largely employed, in Queensland almost any good Eucalyptus timber, and so each State uses the most suitable hardwoods to hand ; but it is not necessary to particularise the timbers in this article, as this special property of timbers is referred to under each species, and the list under the heading, "Trade Applications of Australian Hardwoods," p. 487.

The illustrations will convey some idea of bridge engineering in Australia.

FIG. CLVI.

Photo.] Kempsey Bridge, N.S.W. End view. [*Percy Allan.*

FIG. CLVII.

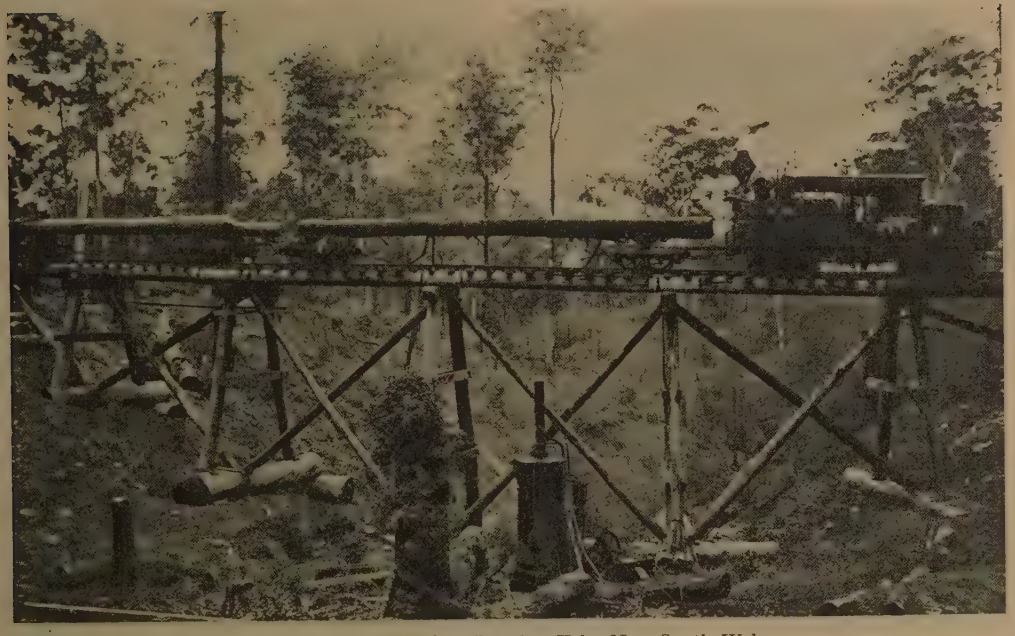
Photo.] [*Percy Allan.*

Kempsey Bridge, containing the longest timber spans (154ft. centre of piers) in Australia, constructed of Ironbark. N.S.W.

FIG CLVIII

Warri Bridge. Local Hardwoods. New South Wales.

FIG. CLIX.



Bush bridge of Hardwoods. Langley Vale, New South Wales.

FIG. CLX

Ironbark bridge. Elliott, Queensland.

FIG. CLXI.

Ironbark foot and road bridge. Dalton Station. Queensland.

FIG. CLXII.

Typical Jarrah bridge. Western Australia.

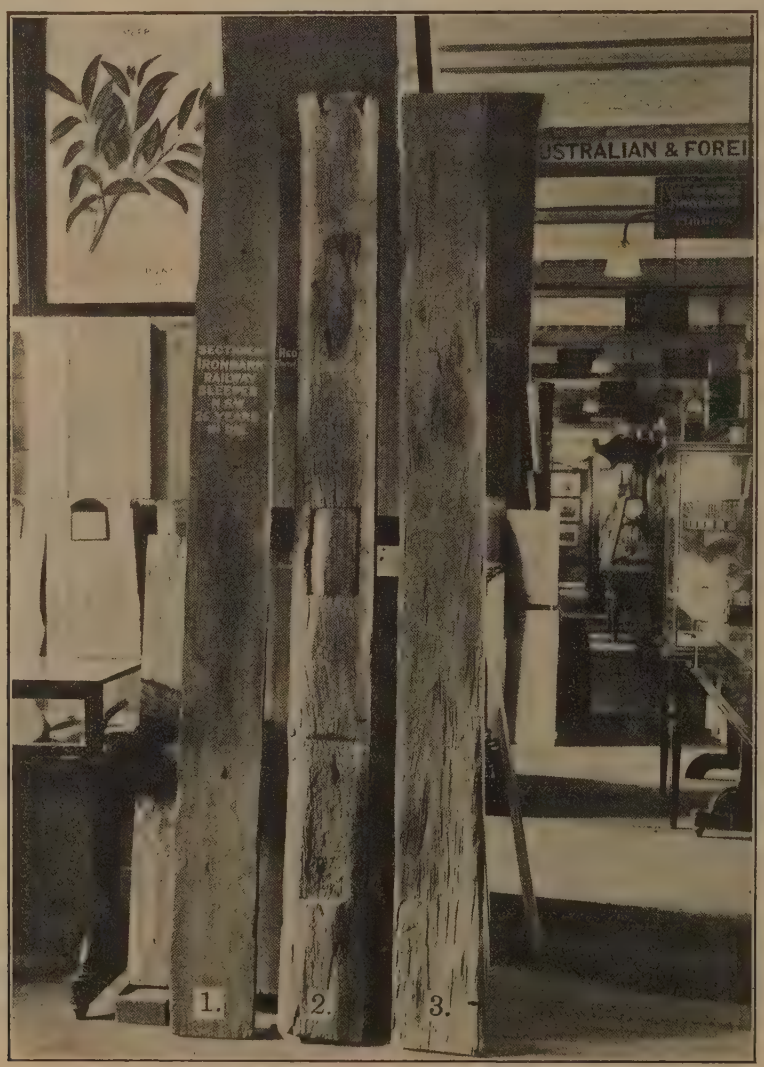
FIG. CLXIII.

Hardwood bridge at Bannister River, Western Australia.

MINING TIMBER.

There can be no doubt that in our hardwoods the Australian miner has an unlimited supply of timbers available for pit props, boards and slabs. The special properties required of a wood in this connection are strength and durability, whilst in some particular cases a timber that splits well is selected. It would not serve any purpose by enumerating some of the species possessing these characteristics which are are found in almost any of the hardwoods adjacent to a mine, where they are utilised for this special industry. Thus in the interior the Mallees are used, and on the ranges and the coast the suitable trees near the mines are laid under tribute. Hence all species or hardwo ds are selected, especially the Eucalypts, these being the most numerous. Newcastle, our largest coal district, obtains its timber from the ranges a few miles from the town.

FIG. CLXIV.



Ironbark sleepers in use by N.S.W. Railways for twenty-five years.
Technological Museum, Sydney.

One illustration will suffice. There is in this museum a piece of wood taken from timbering in the Deep Lead Mine, Forbes, New South Wales, after being thirty years under water, from 1872–1902. It is in a splendid state of preservation showing not the slightest sign of decay, and identified as Murray Red Gum, *Eucalyptus rostrata*. Most of our Eucalyptus timbers would show similar results under such conditions.

At Broken Hill, the greatest mining centre in Australia, the timber favoured for this purpose is Oregon, and the amount consumed is enormous. The nature of the mine often determines the kind of timber used, for if the ground is treacherous, soft-woods are used, but in most other cases any local hardwoods.

RAILWAY SLEEPERS.

The timber *par excellence* for this purpose is undoubtedly *E. paniculata*, *E. siderophloia*, *E. crebra*, *E. Fergusoni*, *E. Nanglei*, *E. Beyeri*, "Ironbarks," and sleepers made from these species have been in use for over twenty-five years in the main trunk suburban lines of Sydney, New South Wales, and show a minimum of wear and are still good for many years yet, see Fig. CLXIV.

FIG. CLXV.

Ironbark sleepers; fifty years in use. Queensland.

In the Eastern States almost any of the better class of Eucalyptus hardwoods make good sleepers, the best for the purpose being:—*E. punctata*, *E. propinqua*, both "Grey Gums"; *E. acmenioides*, *E. umbra*, "White Mahoganies"; *E. microcorys*, "Tallow-wood"; *E. corymbosa*, "Bloodwood"; *E. robusta*, "Swamp Mahogany"; *E. pilularis*, "Blackbutt"; *E. hemiphloia*, "Grey Box"; in fact any of the "Box" group; *E. eugenioides*, "White Stringybark"; and *E. rostrata*, "Murray Red Gum."

The demand for the timbers in the Eastern States has been so great that the supply of Ironbarks is now not equal to the demand, so that other Eucalyptus timbers are found to answer this purpose very well.

In South Australia *E, rostrata*, *E, hemiphloia*, *E, corynocalyx*, are the principal sleeper timbers, and in Western Australia *E. marginata*, "Jarrah," *E. diversicolor*, "Karri," *E. redunca*, "Wandoo," *E. calophylla*, "Red Gum," *E. patens*, "Blackbutt."

In the interior *Callitris* species are preferred as being more immune to white ants, owing to the presence in the timber of a phenol which is toxic to termites. It must be stated, however, that almost all the Eucalyptus hardwoods mentioned in this work are suitable for sleepers.

FIG. CLXVI.

Jarrah forest. Jinker hauling timber for sleepers.

TELEGRAPH POLES.

Whenever procurable Ironbark is used and always preferred, being delivered with about 4 feet of bark attached to prove its identity.

As these timbers are scarcely equal to the demand others of our hardwoods are now being used. In this connection the Electric Light and Power Supply Corporation, Limited, Sydney, state:—

> Our standard specification for poles includes only Blackbutt and Ironbark, but occasionally the Contractors supply Blue Gum, Spotted Gum, and Stringybark.
>
> We find Ironbark far and away the best of all timbers for pole line construction, and we invariably use this for all terminal poles and angle poles where there is an increased strain, and the writer has seen Ironbark poles taken up after being erected eighteen (18) years, and they were perfectly sound.
>
> We find Spotted Gum, Stringybark, and Blackbutt very good timbers where there is no particular strain put on them, but these timbers vary considerably according to the season in which they are cut; if they are cut when the sap is down they last at least twice as long.
>
> Blue Gum we find is the worst of all timbers, as it commences to rot from the inside although the external timber may be perfectly sound, with the result that you have no warning when a pole may fall down, and for this reason we will not use this class of timber at any price. The best class of Ironbark we have yet received comes from the Dungog district.
>
> We use Tallow-wood entirely for the cross-arms, as we find it particularly free from shakes or knots, and does not twist or shrink so much as any of the other timbers.

FIG. CLXVII.

Jarrah forest. Sleeper cutting.

Mr. Walter Gill, Conservator of Forests for South Australia, states :—

The following timbers are used for telegraph poles here :—

Eucalyptus corynocalyx, "Sugar Gum."
E. hemiphloia, "Box Gum."
E. rostrata, "Red Gum."
E. leucoxylon, "Blue Gum."
E. elaeophora, "Bastard Box."
Callitris robusta, "Native Pine."
Eucalyptus obliqua, "Stringybark."
E. capitellata, "Brown Stringybark."

Mr. N. W. Jolly, lately Director of Forests, Queensland, now Forestry Commissioner, New South Wales, states :—

The timber used for Telegraph Poles in this State (Queensland), the Post and Telegraph Department generally specify Grey Ironbark, and occasionally Red Bloodwood and Blackbutt. They also have used Cypress Pine, but do not approve of it. The Railway Department used only Ironbark and Red Bloodwood.

Turpentine has been specified for Telephone poles.

Mr. Lane-Poole, Director of Forests, Western Australia, states:—

The species of timber used in Western Australia for telegraph poles—*E. marginata*, "Jarrah," *E. redunca*, "Wandoo," *E. salmonophloia*, "Salmon Gum."

The approximate annual issue of poles is 1,500; the cross-arms are always made, of "Jarrah."

Mr. H. Mackay, Conservator of Forests, Victoria, informs the author that the principal timbers used for this purpose are:—

E. sideroxylon, "Red Ironbark."

E. hemiphloia and *E. Bosistoana*, "Grey Box."

E. Muelleriana, "Yellow Stringybark."

On the sandy plains and flats of the Southern and South-western districts, *E. obliqua*, "Messmate," and *E. capitellata*, "Brown Stringybark," *E. eugenioides*, "White Stringybark," and *E. macrorhyncha*, "Red Stringybark," are largely utilised for telegraph poles also, the lives of these species for the purpose being as follows:—Messmate and Brown, White and Red Stringybarks, from eighteen to twenty-five years; Yellow Stringybark, from twenty-five to thirty years; Red Ironbark and Grey Box, from thirty to thirty-five years.

The Chief Forest Officer of Tasmania states that in that island—

E. obliqua, "Stringybark," *E. globulus*, "Blue Gum," and *E. Sieberiana*, "Ironbark" are the timbers most commonly used in the State for telegraph poles.

WHARVES.

Certain Australian hardwoods are particularly well adapted for this purpose in all its branches, being used for decking, piles, superstructures, in which positions they have been employed since the foundation of the colony, and have given so much satisfaction that their reputation for durability has become world wide. In fact, one finds them in wharf construction in almost all parts of the world.

As regards piles some species have firmly established their reputation as resisting the *Toredo* and *Limnoria*—the most pronounced destructors of submerged timbers. Undoubtedly the best timber for this purpose is Turpentine, *Syncarpia laurifolia*, its immunity from borers being well recognised. This feature is due to two characteristics, viz., a layer of bast resin cells next to the cambium, and the presence in the dark heartwood of a red deposit in the wood elements of that portion of the stem, and so, naturally, these piles are preferred with the bark on, as they are found to last longer in the water and mud. Many instances of the durability of Turpentine are on exhibition in this Museum.

For years Tasmania has exported largely some very fine logs of *E. globulus* for piers in England and the Continent, their length being one of their chief recommendations. In Australia several of the Ironbarks are used, these ranking in value next to the Turpentine; but many of our hardest Eucalyptus woods are very suitable for this purpose. All piles, other than Turpentine, should be sheathed with copper or Muntz metal, as a protection against the ravages of borers and other marine destructive animals.

Mr. J. E. Bingham informs me that an old pile (*E. Sieberiana*) was recently taken from one of the Piers at Stanley, Tasmania, which had been submerged for thirty years. It is in a good state of preservation and the Teredo has made very little headway during that period.

Species are also used where those above mentioned are not procurable in the locality, the heavier kinds, of course, are selected, being generally the most durable; but this does not always hold, as hardness is sometimes not a guarantee of durability, and one instance might be given, namely, that of *Tristania suaveolens*, Swamp Turpentine or Water Gum, a much inferior timber to Turpentine for piles, although it is sometimes passed as the latter.

The following specifications were drawn up for the supply and delivery of Turpentine piles at the Port Kembla Jetty for the New South Wales Government:—

> Immediately tenders have been accepted the trees from which the piles are to be taken must be ringbarked, but not felled for at least four weeks thereafter, the greatest care being taken not to injure the bark. The bark at the ends must be bound with hoop iron.
>
> Piles must be allowed to remain in the bush for at least two weeks, or such time as the Engineer may decide upon, before removal.
>
> Piles must be perfectly sound, free from all defects, to measure not less than 18 inches in diameter at the head and 15 inches at the toe, exclusive of bark, and to be of the lengths ordered.
>
> Piles will be inspected at the Port of shipment, if so desired by the contractor, but should the engineer, or his responsible officers, find that the piles have become damage or rendered unfit for use through neglect on the part of the contractor to properly stack and protect them during transit or before delivery is taken at Port Kembla, the piles found so defective shall be liable to condemnation, and the contractor shall replace the piles so condemned at his entire cost and expense. Final inspection will be made at Port Kembla.

For a wharf at Newcastle, New South Wales, the specifications were that:—

> Piles shall be of Turpentine, driven with the bark on.

The necessity for keeping the bark intact is recognised by the Auckland (New Zealand) Harbour Board. Fender piles up to 74 feet long and 18 inches in diameter are used. Round piles with the bark intact are specified. The timber must be free from shakes and other defects. The Harbour Board has the timber shipped to them inspected by the Forest Department of New South Wales.

According to A. K. Armstrong (*Engineering,* November 17, 1916), the Japanese engineers have used both the barked and unbarked red Turpentine piles at Yokohama, Kobe, and Kelun (Formosa). The specifications for the Yokohama harbour works called for the timber to be hard, strong, free from splitting, decay, bends, and other defects. Rounding in the side edges (or wane), if present, had to be "under 3 inches," and the piles were to be perfectly square. These squared piles (with the bark removed) did not prove very resistant to the marine wood-borers (ship worm, *Limnoria*, and *Chelura*); and the same was true with the round piles with the bark on used at Kobe. (Possibly these were *Tristania conferta*.—Author.)

The accounts of the life of Turpentine piles show considerable variation. At Sydney Harbour, after a long experiment with Turpentine, the same pieces were used for renewals. The new ones were 4,640 in number, ranging from 40 to 80 feet in length, and the engineer in charge was confident that they would give thirty to thirty-five years' service. However, the New South Wales authorities do not claim that Turpentine is immune from the attacks of the marine wood-borers, but they do assert that with the bark intact it is the only timber they dare drive unprotected by sheathing. Under the precautions observed it evidently gives satisfaction in these waters.

Turpentine piles 70 feet long and from 12 to 14 inches square were driven by the Canadian Pacific Railway from twenty to twenty-five years ago, and are reported to be still in service at Vancouver, British Columbia. According to the reports on hand Douglas Fir, in the same locality, is destroyed by the ship-worm and *Limnoria* in from twelve to eighteen months. There are, however, many instances given where Turpentine has been destroyed in a much shorter time than twenty years. Like most pile timbers, it seems to give the best service in waters contiguous to its habitat, possibly because the methods of handling it are there best understood.

FIG. CLXVIII

Photo.] [*Percy Allan.*

Wharf in course of construction—piles of Turpentine; round girders and hewn timber of Ironbark. Newcastle, New South Wales.

FIG. CLXIX.

Photo.] Wharf in course of construction. Turpentine piles with bark on the right. Newcastle, New South Wales. [*Percy Allan.*

FIG. CLXX.

Wharf nearing completion. Newcastle, New South Wales.

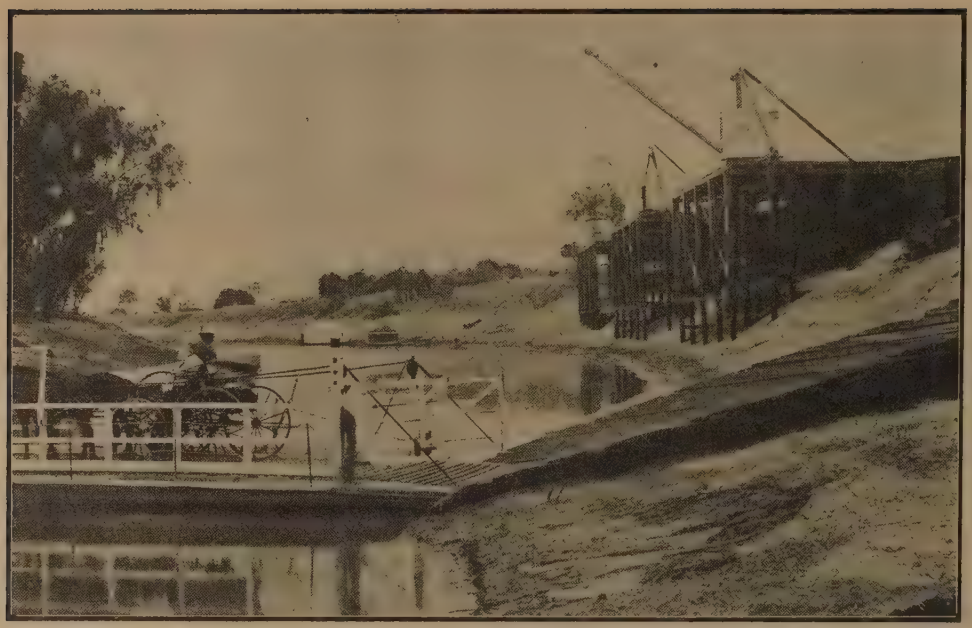
[*Photo.*] [*Percy Allan.*]

FIG. CLXXI.

Wharf completed. Newcastle, New South Wales.
[Mr. Percy Allan, Chief Engineer.]

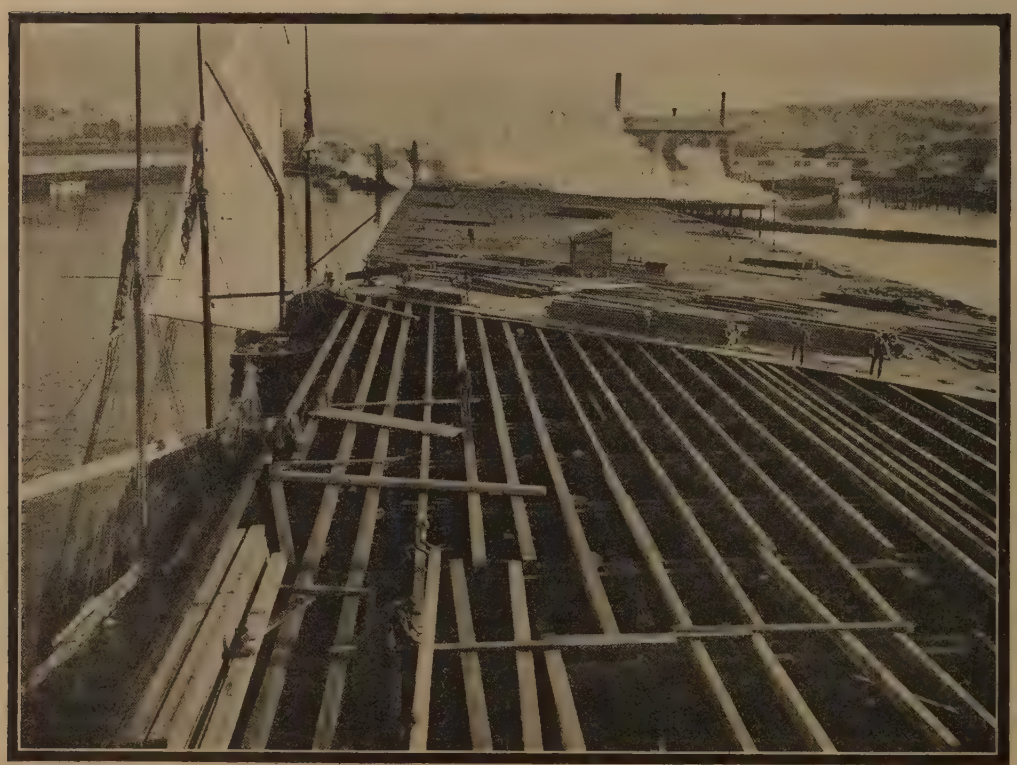
58699—2G

FIG. CLXXII.



Local Hardwood wharf. Bourke, Darling River.

FIG. CLXXIV.

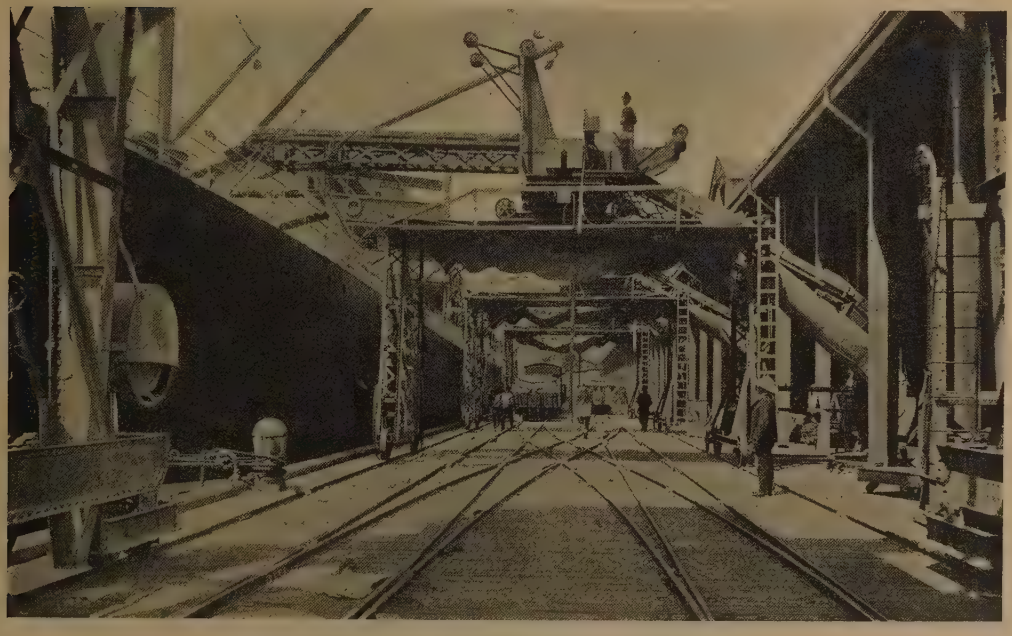


Blue Gum and Stringybark Wharf at Hobart, deepest in the world.

FIG. CLXXV.

Point Sampson Jetty, built of Jarrah. Western Australia.

FIG. CLXXVI.



Jarrah and Karri decking. Fremantle, Western Australia.

FIG CLXXVII.

Photo. by permission] Landing Turpentine piles for New Railway Wharf, Pyrmont, Sydney Harbour. [*R. Dalrymple Hay.*

WOOD-PAVING.

The hardwoods most frequently found on the market are those used throughout the Commonwealth for wood-blocking. The principal New South Wales species being: *Eucalyptus saligna,* "Blue Gum"; *E. pilularis,* "Blackbutt"; *E. resinifera,* "Mahogany"; *E. microcorys,* "Tallow-wood"; *Tristania conferta,* "Brush Box"; *Syncarpia laurifolia,* "Turpentine"; *E. eugenioides* and other "Stringybarks." *E. maculata,* "Spotted Gum," has a bad reputation which is perhaps undeserved, as blocks laid down without removing the sapwood has been the cause of failure.

Each State naturally uses the hardwood most readily procurable for this purpose, for instance in Western Australia, Jarrah, *E. marginata*, and Karri, *E. diversicolor*, are chiefly selected.

All the main thoroughfares in the principal cities of Australia are hardwood blocked, the life varying in different situations. One of the hardest tests is now about to be made. The Port Adelaide Road, extending for a distance of nine miles from Adelaide, South Australia, to the Port has just been laid (under the direction of Mr. W. W. J. Stevens) with blocks of Murray Red Gum, *E. rostrata*. The whole of the heavy traffic from the wharf to the city passes over this road, so that probably there is here the greatest amount of heavy vehicular traffic in the Commonwealth, and the experiment is being watched with interest. As regards Sydney's experience in wood-blocking, the following data obtained from Mr. T. H. Nesbitt, the Town Clerk of Sydney, will be of interest:—

In reply to your letter of the 10th June, 1913, requesting information regarding woodblocks used by the City Council, I have the honor to reply to your questions as follows:—

Question.—A list of timbers used by the City Council for street-paving blocks.

Answer.—In the Council's present specification for the supply of woodblocks are included Blackbutt, Tallow-wood, Grey Gum, Box, Red Gum, Ironbark, and Mahogany. These are excellent timbers and there is little to choose between them.

Question.—What is the result of your past experience of these timbers as to their durability.

Answer.—A careful examination in 1890 of woodblocks removed from King-street between George and Pitt streets, laid with joints 1 inch wide, and grouted with tarred screenings, under traffic ten and a half years, wore at the rate of one twenty-sixth of an inch per annum, and those removed from Pitt-street between King and Hunter streets, opened for traffic during July, 1881 (thirty-two years down), showed wear at the rate of one-sixteenth of an inch per annum. The block laid as an experiment with butt joints in George-street North and opened for traffic during July, 1888 (down twenty-five years), has worn at the rate of one-fiftieth of an inch per annum. These measurements are given upon general average, and the woods were of the classes known as Blackbutt and Tallow-wood. From a report by the City Surveyor on the 31st October, 1893 (for twenty years), the following items are extracts:—

Wear of different woods.

The different timbers have worn as follows:—

Blue Gum ...	...	One-tenth of an inch per annum.
Mahogany ...	...	One-eighth " "
Turpentine ...	...	One-seventeenth " "
Brush Box ...	...	One-seventh " "
Spotted Gum	...	One-seventh " "
Blackbutt ...	...	One-twenty-sixth " "
Blue Gum ...	...	One-twelfth " "
Red Gum ...	...	One-tenth " "

Upon examining blocks removed from George-street (which was opened for traffic in October, 1883), blocks of Spotted Gum were 4½ inches deep showing about 1⅛ inch wear during nine and a quarter years, or at the rate of one-sixth of an inch per annum; blocks of Blue Gum and Grey Ironbark showed wear at the same rate. A concise description of each block examined and carefully measured, as shown in tabulated list of particulars here following, will be of value for future comparisons.

Block.	Name of Street.	Width of Carriage Way.	Class.	Position.	Original Depth.	Average Depth on Removal.	Average Wear.	Date Laid.	Date Removed.	Rate of Wear per Annum.	Width of Joint.
		ft.			in.	in.	in.			in.	in.
A	George-st. ...	79	Grey Ironbark	20 ft. from E. kerb	6	5¼	¾	Oct., 1883	Dec., 1892	1/12	1
B	,, ...	79	Spotted Gum...	20 ,, ...	6	4½	1½	,, 1883	,, 1892	1/6	1
C	,, ...	79	,, ...	18 ,, ...	6	5⅜	⅛	,, 1883	,, 1892	1/13	1
D	,, ...	79	,, ...	24 ,, ...	6	5½	½	,, 1883	,, 1892	1/18	1
E	,, ...	79	Blue Gum ...	24 ,, ...	6	4¾	1¼	,, 1883	,, 1892	1/7	1
F	,, ...	79	,, ...	18 ,, ...	6	4 9/10	1 1/10	, 1883	,, 1892	1/8	1
G	Pitt-st. ..	36	Tallow-wood ...	18 ft. from kerb ...	6	5⅝	⅜	July, 1881	,, 1892	1/15	¾
H	,, ..	36	Blackbutt ...	18 ,, ...	6	5½	⅛	Jan., 1886	,, 1892	1/14	½
J	Castlereagh-st.	36	,, ...	18 ,, ...	6	5 7/10	⅜	,, 1889	,, 1892	1/27	*
K	,, ...	36	,, ...	18 ,, ...	6	5 7/10	⅜	,, 1889	,, 1892	1/27	†¼
L	George-st. ..	64	Tallow-wood ...	30 ft. from W. kerb	6	5⅝	⅜	Oct., 1883	,, 1892	1/16	½

* Butt joint. † Laid diagonally.

Tests made 21–2–1910.

Moore-street.—Woodpaved in 1892 with ¼ inch joints renewed in 1909 with close joints; life seventeen years.

Martin-place.—Woodpaved in 1892 with ¼ inch joints renewed in 1909 with close joints; life seventeen years.

Macquarie-street (part).—Woodpaved in 1886 with ¼ inch joints renewed in 1909 with close joints; life twenty-three years.

Railway Flat.—Heavy traffic, woodpaved in 1887 with ⅜ inch joints renewed in 1906 with close joints; life nineteen years.

Harris-street.—Woodpaved in 1886 with ⅜ inch joints renewed in 1912 with close joints; life twenty-six years.

Union-street (heavy traffic).—Woodpaved in 1891, one-third ¼ inch joints, two-thirds close joints; in fairly good order in 1913.

Streets laid with ¼ inch joints do not give as long a life as streets laid with close or butt joints.

Up till a few years ago blocks were dipped or painted with a coating of hot tar or wood preserving oil. During the last three or four years the blocks in all new works have been subjected to a process of powellising in place of tar or oil, but this has since been discontinued.

FIG. CLXXVIII.

Photo.] Macquarie-street, Sydney. [*Govt. Printer, Sydney.*

Timbers used for blocking, see pp. 469 and 470.

FIG. CLXXIX.

Photo.] *C. F. Laseron.*

Sussex-street, Sydney. Woodblocked with Blackbutt, Brush Box and Red Gum.

FIG. CLXXX.

Photo.] *[W. W. J. Stevens.*

Woodblocked with Murray Red Gum. This road, connecting Port Adelaide with Adelaide itself, distant 9 miles, has probably a heavier traffic than any other in Australia. South Australia.

FIG. CLXXXI

Paved with S. A. Hardwoods. King William Street, Adelaide.

FIG. CLXXXII.

Photo.] [*Russell Grimwade.*

Paved with Jarrah blocks. St. Kilda Road, Melbourne, Victoria.

FIG. CLXXXIII.

Paved with Jarrah blocks. Perth, Western Australia.

FUEL.

Amongst our hardwoods the "Box" timbers bring the highest prices in the market as fuel, which is due to the high calorific value of this wood over its congeners. Little attention is paid to species yielding domestic wood for fuel in Australia, as fallen timber, which encumbers the brush and forests, appears, in a great measure, to meet the demand.

In other countries it is perhaps a matter of some concern, and in America Eucalypts are planted especially for this purpose, being the quickest growers—a record for hardwood.

Casuarina wood is employed mostly by bakers for their bread ovens, and the bark of Ironbarks is used solely by wheelwrights for heating the tyres prior to placing them on the wheels.

Very few of our hardwoods are unsuitable for firing, the greatest exception being Turpentine, *Syncarpia laurifolia*.

TURNERY.

This is such a comprehensive term that almost any timber can be turned into something useful or ornamental, some of course possessing a texture which gives them a superiority over many others for this commercial purpose. Thus a special quality of timber is required for wooden screw threads and so on.

Even the hardest and best Ironbarks can be turned into naves and spokes of a wheel.

Some of our hardwoods are more decorative than others for turnery, thus the Casuarineas (except "Belah") and Proteaceæ particularly lend themselves to this trade, and there are many others such as *Zanthoxylum brachyacanthum, Tarrietia, Geijera, Acacia* and almost any of our *Eucalypts.*

VENEERS.

The beautiful figures that have recently been shown to exist in our hardwoods has led to their greater utilisation for decorative or cabinet work, and furniture made from them is now coming greatly into vogue.

As our hardwoods are heavy in the solid, this disadvantage could be overcome when cut into veneers and using them for ply work.

The following are recommended :—

RED.

Alphitonia excelsa.
Grevillea Hilliana.
G. striata.
Telopea oreades.
Banksia serrata.
Casuarina spp.

DARK.

Eremophila Mitchelli.
Geijera Muelleri.
G. salicifolia.
Harpullia pendula.
Acacia penninervis.
A. melanoxylon.

YELLOW.

Zanthoxylum brachyacanthum.

PALE YELLOW.

Bosistoa sapindiformis.
B. euodiformis.
Evodia erythrococca.
Pentaceras australis.
Achras australis.

PALE.

Flindersia Bennettiana.
Villaresia Moorei.
Eucalyptus regnans.
E. Delegatensis.

The history of the veneered hardwood door in America is interesting in this connection, and reveals what a splendid new field of utility for our hardwoods exists in Australia :—

> The hardwood door, as a veneer product, dates the beginning of its present rise in about 1902. Some veneered hardwood doors had been made by American planing mills for many years, largely to architects' specifications. In Europe solid hardwood doors were made practically as far back as we can trace the history of architecture. They were hand-made, and constructed for massiveness and strength. This line of construction is entirely different from the door of to-day in the States, which, so far as the hardwood branch is concerned, goes back not quite fifteen years. About 1902 the Paine Lumber Company, which had been an important operator in pine in the territory around Oshkosh, Wisconsin, found the supply of pine timber giving out in Wisconsin, and looked around either for some place to go for further operations or something else to do in that locality. The company had in its stumpage, says "Hardwood Record" of Chicago, a lot of birch, which had not at that time been extensively marketed as a commercial product, and had never been much used in door making. After making a study of the possibilities of this hardwood, the company worked out and put into execution a plan for making veneered doors on a large scale, and put them on the market in stock sizes in competition with the solid pine doors, which were almost the exclusive feature of that time. It took a lot of work and money to fit up plants to carry out the ideas, and it looked like a daring proposition. The company went at it, and the result of the effort was to make the birch veneered door a conspicuous item in the door trade of the country. The door was advertised extensively, and it found a field in competition with softer woods, not at a smaller price but at a higher. The pronounced success of this undertaking encouraged others to take up the work, and pretty soon other woods than birch were making their appearance in the form of veneered doors. The next one to show largely was oak, which in time was followed by gum and then mahogany and fancy figured woods, and finally even the pine and fir people turned to veneering to make door panels. Meantime, the veneered hardwood door was giving such satisfaction that not only architects were specifying this type of door for the more elaborate homes, but the builders of model homes also wanted it, and the planing mills of the country found themselves called upon to make so many veneered doors that they were compelled to equip glue-rooms and veneer departments to do this work. To-day the hardwood door is not only a conspicuous item in the market, but it is an important line of work with nearly all planing mills.

WOOD-CARVING.

There is quite a new field of technology in the employment of our hardwoods in this connection, and the much despised Stringybarks probably head the list of all Australian hardwoods for this purpose. As regards the carving qualities of our hardwoods only in the last few years has any attention been paid to the subject so that here is a big field for the wood-carver awaiting exploitation. Western Australia can show some splendid specimens of Jarrah, fully demonstrating the suitability of that timber for this form of decoration. Tasmania has also quite recently excelled in its productions of Stringybark wood-carving, some of which are here produced. A number of New South Wales species have been experimented with, and Mr. F. W. Tod, who carried out the carving under my direction, reports on them as follow; and as there are many timbers of similar texture, weight, and colour to those tested, much investigation work remains to be done in this technical subject.

FIG. CLXXXIV.

Black Bean panel.

Acacia pendula, A. Cunn, "MYALL."

This is an extremely hard timber, of a nature more like bone to cut, but gives a most excellent finish, almost similar to a piece of polished bronze. It is very heavy, and likely to splinter; to cut against the grain is almost impossible and likely to be disastrous to the tool. One cannot "set in" in such wood, all waste requires to be gauged away first even in a small crevice, and the edge finally pared clean. Chips fly off as if one were cutting stone, and the edge of the tool becomes "clubbed" with the first cut; but one can plod along with it blunt, nevertheless, and cut as well as is possible. It is not too much to assert that a piece of work would take ten times as long to do as would be the case in an ordinary carving timber. It is suitable for fancy work, such as the specimen, turnery, and such things as drum-sticks, &c.

Melaleuca Smithii, R.T.B., "TEA TREE."

This timber is similar in appearance, texture, and cutting qualities to French or Italian "Walnut." It could very well be used in the place of these timbers, and would be admirably suited for interior fittings of fine buildings. It is an excellent wood for carving, and lends itself to what is termed "slick" effect. It is tough, but cuts with a crispness which modifies this. Other specimens of the timber may differ, but it seemed to require (in this specimen) keen tools on portions of the end grain. It certainly deserves to be more widely used.

The subject of this specimen represents a portion of a pilaster in Louis XIV or Regency style, early eighteenth century.

Eucalyptus marginata, Sm., "JARRAH."

This is one of the best hardwoods for carving. Its texture is better described as hard than tough. It responds to the tool with a crispness which enables a carver skilled in smart cutting to produce a brilliant effect and vivacious modelling. The grain is fairly straight and has no figure to speak of—another reason why it is suitable for carving.

In appearance it is not unlike Spanish Mahogany when new, but slightly more of a reddish hue. Exposure to air soon changes this and produces more of the tone of the one mentioned. In work of considerable depth a fair amount of hard work is encountered, for one cannot drive a tool very far into it without risk to the tool; "but along the grain," wood flies off very readily. It cuts "as fresh as a carrot" in ordinary positions, but is inclined to be brittle.

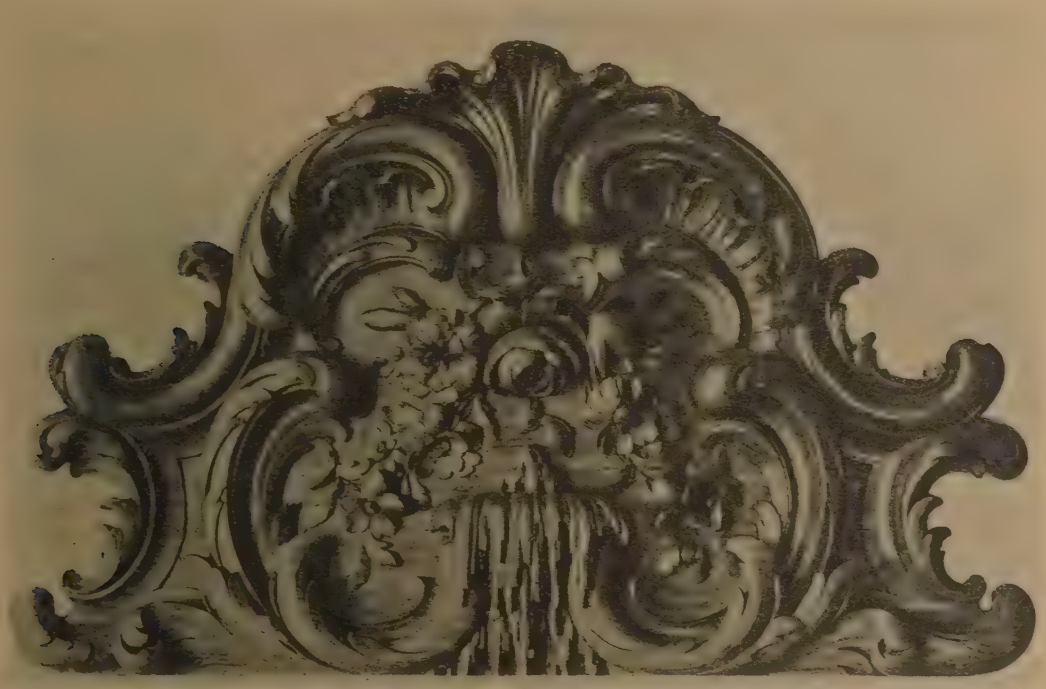
FIG. CLXXXV.

Jarrah Reredos. Western Australia.

Where *E. saligna*, Blue Gum, is employed for fitments, Jarrah could be used in conjunction for any carving. The colour would match but the difficulties and excessive figure of Blue Gum would be obviated.

The specimen is a reliable though limited example of one of the most gorgeous periods of French decoration, viz., Louis XV, mid. eighteenth century. In contrast with Louis XIV it lacks the dignity which characterises that period and may be described as Louis XIV run wild. This of course is not clearly demonstrated in this small specimen, one would need a fairly large scheme to show it to advantage. Withal, it is a pleasing and suitable style for certain situations; the flowers, whilst conventionalised, are treated more naturally than in Louis XIV. The dripping water or icicles are a prominent feature of the style and is confined to it alone.

FIG. CLXXXVI.



Jarrah. Carved in Louis XV Style.

Eucalyptus saligna, Sm., "SYDNEY BLUE GUM."

This exceptionally fine red timber, closely resembling Sabaque or a coarse-grained Cuba Mahogany, would prove an excellent wood for furniture or fitments, and in such situations is capable of being carved; but it is not an ideal wood for carving, nor is it to be recommended for that purpose alone. Highly figured timbers usually interfere with the effect sought by the carver.

It is extremely hard and brittle, and cuts crisply "with the grain," but the waviness and strength of the fibres, and the tendency to "splinter," provides a maximum of difficulties. Only in the most experienced of hands can any degree of satisfactory finish be expected with it, and even then only at considerable expense of time and patience. But undoubtedly the effect in any scheme where it is employed would be superb.

Eucalyptus Delegatensis, R.T.B., "MOUNTAIN ASH."

The specimen represents a conventionalised Waratah design for a cave freize or cornice moulding, and is treated in a Georgian manner. It should be really slightly more curved, but I have made the most of the thickness of the wood, glueing blocks on for prominent parts. One section of design—which can be repeated *ad lib.*—is shown and is sufficient, I think, to demonstrate the idea. The bracts are treated full so as to make a broad mass, and to counteract the amount of colour or shadow of the flowers, which need to be clothed well to avoid unnecessary work, besides too "straggly" an appearance. The seed pods lend themselves well to a scroll terminal,

FIG. CLXXXVII.

Mountain Ash (*E. delegatensis*) carved panel, Waratah.

but, in full relief such as this, it means a considerable amount of labour. The foliage is developed more in outline than one usually sees, but I am of opinion that this is a pardonable error in architectural treatment, in order to avoid monotony. It also helps to "carry the line around," as we say.

The timber is very similar in appearance and texture to English and American Ash; tough, strong and flexible, but rather liable to split and develop shakes and "doughty" streaks or layers between the annual rings, which are only discovered when the wood is removed. This constitutes a rather serious defect, and is liable to give much

annoyance and disappointment in execution of good work. Possessing a similar acid to Oak, &c., it readily turns black with moisture of hand, or, if at all damp, with the friction of the tools. Otherwise it is a good wood for carving, and could be utilised for fitments and furniture. It cuts well and is capable of a clean effective finish, though requiring in places much patience to remove tiny fibres from corners and crevices, which need to be completely severed with sharp tools, and cannot be flicked out as in ideal carving timbers.

FIG. CLXXXVIII.

Mountain Ash alter panel.

FIG. CLXXXIX.

Mountain Ash Church screen. Tasmania.

Eucalyptus tereticornis, Sm., "RED GUM."

This timber is suitable for carving, but owing to its extreme hardness it would not compare at all favourably with others for commercial purposes, except where durability is essential, for in this case carvings of this timber would last hundreds of years under proper treatment, and so it might be suitable for furniture or interior fittings where the cost of production is not limited, it being clean grained, and producing a good sheen or finish. As far as its cutting qualities are concerned, in addition to its hardness it occasionally contains particles of grit, which naturally has a bad effect on the tools, and so time is taken in resharpening. However, the cost of carving this timber would be morethan compensated for when one comes to do work of the Grinling Gibbons' type, involving, as it does, much intricate undercutting, which work necessarily would become very fragile in a soft timber, whereas the hardness of this wood gives it a permanent character.

FIG. CXC.

Eucalyptus tereticornis, Sm. Grinling Gibbons' type.

In comparison to the suitability of *Tilea Europea*, Lime Tree; *Gmelina Leichhardtii*, Colonial Beech; *Fagus Cunninghamii*, Red Myrtle, and other light timbers it does not compare at all favourably for rapidity of treatment, but the set off to this is the very slender or delicate parts in high relief being so much stronger in this respect than the above-mentioned European and Australian timbers. See end of book, Fig. CXCIV.

Eucalyptus eugenioides, Sieb., "WHITE STRINGYBARK."

Though this timber is very heavy and hard, it is a delightful wood to carve, for a splendid effect is obtainable owing to the crispness with which it cuts and the sharpness it retains. It is similar, in this respect, to Spanish Mahogany, and also in the tendency of the grain. On account of its hardness it cannot be carved quickly; nevertheless, a hard, crisp wood is preferable as a carving timber to one that is merely tough.

The subject figure represents a trophy in Louis Seize style.

FIG. CXCI.

White Stringybark (*E. eugenioides*) panel. Louis VI period.

58699—2 H

Sideroxylon Pohlmanianum and Sideroxylon australe, "BLACK APPLE."

These are excellent timbers ior carving in cases where an exceptionally fine finish or sharpness is required. The former variety is exactly the same to work as English or Turkish "Boxwood," and would answer for all purposes where they are

FIG. CXCII.

Stringybark (*E. obliqua*) carved capital.

employed, *e.g.*, moulds for compo. or plastic ornaments, printers blocks (which are cut on end grain). The grain is of very even texture; compact, but not the least fibrous, and can be cut to almost any direction in finishing. Whilst such a timber can be procured, there is no necessity to import "Boxwood."

Sideroxylon australe possesses a slight figure, which gives it the appearance and qualities of the "Satinwood" used in Sheraton furniture, but it has the advantage for the carver of not being so wavy or "cross." For small detail or bas relief figure panels and a brilliant effect it would be hard to equal. If cut into veneer, it would be eminently suited for marquetry or inlaid work.

FIG. CXCIII.

Black Apple (*Sideroxylon australe*) carving for a mould.

AUSTRALIAN SUBSTITUTES for some exotic or imported Hardwoods.

The timbers of Australia possess such a diversified texture, grain, colour, weight, and other characters, that suitable woods can be found to supply the desiderata of almost any trade.

As this fact is such a valuable commercial asset of our forests, it is of great importance that the timbers mentioned below should be extensively planted for future use.

These are arranged below with the idea of bringing together the names of Australian woods, which in texture especially, and in weight and colour, might be classified with the well-known, old-world timbers, for which they would make good substitutes.

1. APPLE OR PEAR (English or American).

Broad-leaved Tea Tree	Melaleuca Smithii, R.T.B.
Do do	M. Maideni, R.T.B.
Cheese-wood	Pittosporum bicolor, Hook.
Coach-wood	Ceratopetalum apetalum, D. Don.
Lignum Vitæ, or Black Satin-wood	Vitex lignum vitæ, A. Cunn.
Plum-wood	Eucryphia Moorei, F.v.M.
Yellow-bark	Celastrus dispermus, F.v.M.

2. ASH (English and American).

A Mountain Ash	Eucalyptus Consideniana, Maiden.
Southern Mountain Ash	E. Delegatensis, R.T.B.
White Ash	E. fraxinoides, H.D. et J.H.M.
Smooth-barked Mountain Ash	E. oreades, R.T.B.
Mountain Ash	E. Sieberiana, F.v.M.

3. BEECH (Fagus).

N.S.W. Maple	Villaresia Moorei, F.v.M.
Foley-wood	Hakea saligna, R.Br.
Mararie	Weinmannia lachnocarpa, F.v.M.
Native Cherry	Exocarpus cupressiformis, Labill.
Negro-head Beech	Fagus Moorei, F.v.M.
Tasmanian Red Myrtle	Fagus Cunninghamii, Hook.
Yellow-bark	Celastrus dispermus, F.v.M.

And several of those mentioned below under "Boxes."

4. BOX. (Similar to English Box, *Buxus sempervirens*, Linn.)

Axe Breaker	Geijera Muelleri, Benth.
Blue Ash...	Elæodendron australe, Vent.
Boogoogin	Halfordia drupifera, F.v.M.
Kerosene tree	H. scleroxylon, F.v.M.
Box Thorn or Black Thorn	Bursaria spinosa, Cav.
Black Apple	Sideroxylon australe, R.Br.
Do	S. Pohlmanianum, F.v.M
Billardier's Phebalium	Phebalium Billardieri, A. Juss.
Leopard-wood	Flindersia maculosa, F.v.M.
Logan Apple	Acronychia acidula, F.v.M.
Native Lemon	Capparis nobilis, F.v.M.
Do Orange	C. Mitchelli, Lindl.
Do Guava	Siphonodon australe, Benth.
Soap-wood	Evodia erythrococca, Benth.
Union Nut	Bosistoa sapindiformis, F.v.M.
	B. euodiformis, F.v.M.
Wollum Wollum	Hymenosporum flavum, F.v.M.
White-wood	Evodia micrococca, F.v.M.
Yellow Hickory	Psychotria nematopoda, F.v.M.
Yellow-wood	Daphnandra micrantha, Benth.
	Bouchardatia neurococca, Bail.
	Citriobatus lancifolius, Bail.

5. ELM—Ulmus—(English).

White Cedar	Melia Azedarach, Linn.

6. GREENHEART—Nectandra.

Beetroot	Cupania nervosa, F.v.M.
Brush Apple	C. pyriformis, F.v.M.
Bungarie	C. tomentilla, Linn.
Brush Teak	Ratonia tenax, A. Cunn.
Bone-wood	Emmenospermum alphitonioides, F.v.M.
Carrot-wood	Cupania anacardioides, A. Rich.
Iron-wood	Geijera salicifolia, Schott.
Pomatum-wood	Beilschmiedia obtusifolia, Benth.
She Beech	Cryptocarya obovata, B.Rr.
	C. triplinervis, R.Br.
	C. patentinervis, F.v.M.
Tamarind	Diploglottis Cunninghamii, Hook.
Teak	Flindersia australis, R.Br.
Wild Quince	Cupania semiglauca, F.v.M.
	Bosistoa euodiformis, F.v.M.
Union Nut	B. sapindiformis, F.v.M.
Yellow-wood	Daphnandra micrantha, Benth.
	Nephelium foveolatum, F.v.M.
	N. leiocarpum, F.v.M.

7. HICKORY (American).

Narrow-leaved Peppermint	E. Australiana, R.T.B. et H.G.S.
Sally or Scrub Hickory	Acacia Maideni, F.v.M.
Scrub Hickory	Pentaceras australis, Hk.
Scrub Wattle	Acacia Bakeri, J.H.M.

8. HORNBEAM—Carpinus.

Beetroot	Cupania nervosa, F.v.M.
	Nephelium foveolatum, F.v.M.
Maple	Villaresia Moorei, F.v.M.
Feather-wood	Polyosma Cunninghamii, J. J. Benn.
Soap-wood	Evodia octandra, F.v.M.
White Holly	Pittosporum rhombifolium, A. Cunn.

9. LIGNUM VITÆ, OR IRON-WOOD.

Belah	Casuarina Cambagei.
Black Plum	Cadellia monostylis, Benth.
Lignum Vitæ, or Black Satin-wood	Vitex lignum vitæ, A. Cunn.
Iron-wood	Geijera salicifolia, Schott.
Myall	Acacia pendula, A. Cunn.
Yarran	A. homalophylla, A. Cunn.

10. MAPLE OR SYCAMORE.

Brown Beech	Cryptocarya glaucescens, R.Br.
Doura	Symplocos spicata, Roxb.
Feather-wood	Polyosma Cunninghamii, J. J. Benn.
Grey Myrtle	Backhousia myrtifolia, Hook. et Harv.
Logan Apple	Acronychia acidula, F.v.M.
Maple (N.S.W.)	Villaresia Moorei, F.v.M.
	Pennantia Cunninghamii, Miers.
Red Apple	Eugenia brachyandra, J.H.M. et E.B.
Yellow Bark	Celastrus dispermus, F.v.M.
	Decaspermum paniculatum, Bail.
White Holly	Pittosporum rhombifolium, A. Cunn.

11. OAK—Quercus.

(*a*) Colour.	
Bush Nut or Possum Nut	Macadamia ternifolia, F.v.M.
(*b*) Figure.	
Bull Oak	Casuarina Luehmanni, R.T.B.
Bull Silky Oak	Cardwellia sublimis, F.v.M.
Forest Oak	Casuarina torulosa, Ait.
Hill Oak	C. stricta, Ait.
River Oak	C. Cunninghamiana, Miq.
Shee Oak	C. suberosa, Ott. et Diet.
Do	C. Fraseriana, Miq.
Silky Oak	*Grevillea robusta, A. Cunn.
Do	*Orites excelsa, R.Br.

12. SATIN-WOODS.

Brush Ash or Yellow-wood	Acronychia Baueri, Schott.
Logan Apple	A. acidula, F.v.M.
Scrub Hickory	Pentaceras australis, Hk.
Thorny Yellow-wood	Zanthoxylum brachyacanthum, F.v.M.
Yellow Cedar	Rhodosphæra rhodanthema, Engl.
Bone-wood	Emmenospermum alphitonioides, F.v.M.,

Most pale-coloured Eucalypts with a figure, such as

A Stringybark	E. obliqua, L. Her.
Black-butt	E. pilularis, Sm.
Mountain Gum	E. goniocalyx, F.v.M.
Southern Mountain Ash	E. Delegatensis, R.T.B.
Spotted Gum	E. maculata, Hook.

13. WALNUT—Juglans.

Black Bean	Castanospermum australe, A. Cunn.
Queensland Walnut	Cryptocarya Palmerstoni, Bail.
Myall	Acacia pendula, A. Cunn.
Belah	Casuarina Cambagei, R.T.B.

Trade Application of Australian Hardwoods.

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1. BEAMS.

Eucalyptus paniculata, E. crebra, E. siderophloia, E. Fergusoni, E. Nanglei, E. Beyeri	Ironbarks.
E. globulus	Tasmanian Blue Gum.
E. microcorys	Tallow-wood.
E. marginata	Jarrah.
E. diversicolor	Karri.
Flindersia australis	Teak.
Syncarpia laurifolia	Turpentine.
Eucalyptus virgata	Tasmanian Ironbark.

For Smaller Beams.

Eucalyptus acmenioides	White Mahogany.
E. hemiphloia	Grey Box.
E. pilularis	Blackbutt.
E. tereticornis	Forest Red Gum.
E. maculata	Spotted Gum.
E. eugenioides	White Stringybark.
E. Raveretiana	Iron Gum Tree.

2. BENDING TIMBERS.

Eucalyptus maculata	Spotted Gum.
E. fraxinoides, E. Delegatensis, E. oreades, E. regnans	Mountain Ash.
Acacia melanoxylon	Blackwood.
Flindersia Oxleyana	Long Jack.
F. spp	
Several species	Stringybark.

3. BOAT BUILDING (See under article "Ship-building.")

4. BRIDGES. (Braces, Decking, &c.)

Braces.

Almost any of the best hardwoods are used in this connection, procurable in the neighbourhood where the bridge is to be erected.

5. BROOM HANDLES.

These domestic articles are generally made from scraps and not any specified timber, but the following are probably the best for this purpose :—

Eucalyptus fraxinoides, E. oreades ...	Mountain Ash.
E. regnans, E viminalis ...	Gums.
E. Australiana	Peppermint.

6. BUILDING (Houses).

Joists, plates, flooring, rafters, beams, window frames, weatherboards—almost any of the Eucalypts which occur in or nearest to the neighbourhood in which the house is being built are used for these, and being classed as hardwoods, answer the purpose admirably.

For weatherboards, red timbers, such as the Sydney Blue Gum, Mahoganies, and Jarrah are now coming into vogue, and when varnished give the bungalow or cottage a good appearance.

7. CABINET AND FURNITURE.

There is quite a preference existing at the present time for the utilisation of our hardwoods in these industries, and the timbers coming into favour are :—

Acacia melanoxylon	Blackwood.
Eucalyptus obliqua, E. eugenioides ...	Stringybarks.
E. Delegatensis...	Mountain Ash.
E. maculata	Spotted Gum.
E. marginata	Jarrah.

Any of the following could also be used with good effect :—

Acacia salicina	Eumung.
Castanospermum australe	Black Bean
Eucalyptus saligna	Sydney Blue Gum.
Villaresia Moorei	N.S.W. Maple.
Tarrietia argyrodendron	Crowsfoot Elm.
Flindersia Oxleyana	Long Jack.
Alphitonia excelsa	Red Ash.
Daphnandra micrantha	Yellow Wood.
Grevillea spp.	*Silky Oaks.
Stenocarpus sinuatus, S. salignus. ...	*Fire Tree (Beefwood).
Casuarina spp.	Shee Oaks.

8. CARRIAGE AND COACH BUILDING.

(For wheels and spokes, see under "Wheelwrights' Work.")

Constructional.

Eucalyptus Delegatensis, E. fraxinoides, E. oreades, E. regnans	Mountain Ash
E. maculata	Spotted Gum.
E. marginata	Jarrah.
E. tereticornis	Forest Red Gum.
E. rostrata	Murray Red Gum.
E. propinqua	Grey Gum.
E. longifolia	Woolly Butt.
E. gomphocephala	Tuart.
E. pilularis	Blackbutt.
E. loxophleba	York Gum.
E. globulus	Tasmanian Blue Gum.
E. obliqua	Tasmanian Stringybark.

Decorative.

Tarrietia argyrodendron	Crowsfoot Elm.
T. actinophylla	Ironwood or Black Jack.
Acacia melanoxylon	Blackwood.
Stenocarpus spp....	*Fire Tree.
Banksia spp.	*Honeysuckle.
Grevillea spp.	*Silky Oaks.
Villaresia Moorei	N.S.W. Maple.
Casuarina spp.	Shee Oaks.
Acacia salicina	Eumung.
Zanthoxylum brachyacanthum... ...	Thorny Yellow-wood.
Acacia Bakeri	Hickory.
Castanospermum australe	Black Bean.
Cryptocarya Palmerstoni	Queensland Walnut.
Any of the larger species	Tea Trees.

9. CARVING.

Eucalyptus obliqua, E. eugenioides ...	Stringybarks.
E. Delegatensis, E. viminalis	Mountain Ashes.
E. saligna	Sydney Blue Gum.
E. tereticornis	Forest Red Gum.
E. marginata	Jarrah.
Pittosporum undulatum...	Pittosporum.
Many of the pale coloured species ...	Rutaceæ.
Acacia pendula	Myall.
Castanospermum australe	Black Bean.
Sideroxylon spp.	Black Apple.
Flindersia Oxleyana	Long Jack.

* Softwoods.

10. COG WHEELS (Teeth).

Casuarina Cambagei	Belah.
Flindersia australis	Teak.
Acacia pendula	Myall.
Eucalyptus microcorys	Tallow-wood.
E. Thozetiana	Australian Lignum vitæ.
Backhousia myrtifolia	Grey Myrtle.
Geijera Muelleri	Axe breaker.
Weinmannia lachnocarpa	Mararie.
Vitex lignum vitæ	Lignum Vitæ.
Exocarpus latifolius	Sydney Cherry.

11. COOPERAGE.

Eucalyptus fraxinoides	Southern Ash.
E. regnans, E. Delegatensis ...	Mountain Ash.
Acacia melanoxylon	Blackwood.
A. dealbata	Silver Wattle.
Grevillea robusta...	*Silky Oak.
Orites excelsa	*Silky Oak.
Flindersia Oxleyana	Long Jack.

12. DESTRUCTIVE DISTILLATION.

Almost any of the timbers can be used for this purpose. Messrs. Cumin, Smith & Co., Warburton, Yarra Junction, Victoria, use *E. regnans* principally, being the most numerous species in the locality of their mills, but other similar woods occurring in the neighbourhood are also distilled.

13. DRAY POLES.

Eucalyptus spp	Ironbarks.
E. microcorys	Tallow-wood.
E. maculata	Spotted Gum.
E. citri dora	Lemon scented Gum.
E. diversicolor	Karri.
E. gomphocephala	Tuart.
E. redunca	Wandoo.
E. cornuta	Yate.
E. longicornis	Morrell.
Flindersia australis	Teak.
F. Oxleyana	Long Jack.
F. Ifflaiana	Cairns Hickory.

14. FELLOES.

Eucalyptus saligna	Sydney Blue Gum.
E. tereticornis	Forest Red Gum.
E. spp.	Ironbark.
E. punctata.	Grey Gum.
E. propinqua	North Coast Grey Gum.
E. diversicolor	Karri.
E. gomphocephala	Tuart.
E. redunca	Wandoo.
E. maculata	Spotted Gum.
E. loxophleba	York Gum.

15. FENCING AND POSTS.

Most of the Eucalyptus species are useful for this purpose, but, of course, some have a greater reputation for durability than others, thus, Yellow Box (*E. melliodora*) appears to be almost indestructible in the ground.

Blackbutt (*E. pilularis*) is also a good post timber, whilst Ironbark species are also very durable.

White Stringybark (*E. eugenioides*) is very durable in the ground.

16. FLOORING.

Tallow-wood (*E. microcorys*) is considered the most durable of all woods for this purpose, but other Eucalyptus species are used, such as Stringybarks (E. spp.), Blackbutt (*E. pilularis*). Spotted Gum (*E. maculata*) should not be used unless free of sapwood.

Many other hardwoods would, no doubt, be found equally suitable if tried in this connection.

17. FRAMING.

Almost any of the Eucalyptus species, and especially the Teaks, *Flindersia australis Flindersia Bennettiana*, and *Flindersia Oxleyana*.

*Softwoods.

18. FUEL.

Almost any hardwoods are suitable, except Turpentine (*Syncarpia laurifolia*) and Woollybutt (*E. Bridgesiana*), but the best fuel wood is that obtained from the Boxes, which always command the highest prices in the market.

Shee Oaks (*Casuarinas*) possess high colorific value.

19. FURNITURE (See also Cabinet Work).

Eucalyptus obliqua, E. eugenioides, E. Delegatensis	Stringybarks.
E. marginata	Jarrah.
E. saligna	Sydney Blue Gum.
E. maculata	Spotted Gum.
Casuarina spp.	Shee Oaks.
Melaleuca spp.	Tea Trees.
Acacia pendula. (Some special articles)	Myall.
A. melanoxylon	Blackwood.
Cedrela Toona	*Cedar.
Grevillea spp., Cardwellia sublimis, and Orites excelsa	*Silky Oaks.
Flindersia Chatawaiana	*Queensland Maple.
Ceratopetalum apetalum	*Coachwood
Dysoxylon Muelleri	*Red Bean

20. GIRDERS.

Ironbarks whenever obtainable, and, next to these, Boxes, Tallow-wood, Teak, and Karri.

21. GUN STOCKS.

Melaleuca Maideni, and M. Smithii ...	Tea Tree.
Cryptocarya Palmerstoni	Queensland Walnut.
Acacia melanoxylon	Blackwood.

Queensland Maple is also being tried.

22. GOLF STICKS.

(*a*) **Heads.**

Weinmannia lachnocarpa	Mararie.
Melaleuca Smithii	Tea Tree.
Acacia salicina	Eumung.
Backhousia myrtifolia	Grey Myrtle.
B. sciadophora...	Myrtle.
Tristania laurina	Water Gum.
Exocarpus cupressiformis	Native Cherry.
E. latifolius	Sydney Cherry.
Pittosporum undulatum...	Pittosporum.

(*b*) **Shafts.**

Eucalyptus maculata	Spotted Gum.
E. regnans	Giant Gum.
E. Australiana	Narrow-leaved Peppermint.
E. Delegatensis	Southern Mountain Ash.
E. oreades	A Mountain Ash.
E. fastigata	A Stringybark.
E. fraxinoides	White Ash.
Flindersia Oxleyana	Long Jack or Yellow-wood.
Pentaceras australis	Scrub Hickory.
Eucryphia Billardieri	Leatherwood

23. HANDLES (Tools, Axe, &c.).

Axe.

Eucalyptus Delegatensis, E. fraxinoides, E. regnans	Mountain Ashes.
E. viminalis	Ribbony Gum.
E. maculata	Spotted Gum.
E. rubida	Mountain Gum.
E. Australiana	Narrow-leaved Peppermint.
E. tesselaris	Carbeen.
Flindersia australis	Teak.
Acacia Bakeri.	Hickory.

* Softwoods.

Tools.

Eucalyptus longicornis	Morrell.
E. hemiphloia	Box.
E. Fletcheri	River Box.
Tristania conferta	Brush Box.
T. laurina	Water Gum.
Backhousia myrtifolia	Grey Myrtle.
Geijera Muelleri	Axe-breaker.
Harpullia pendula	Tulip Wood.
Acacia pendula	Myall.
Avicennia officinalis	Grey Mangrove.
Casuarina Cambagei	Belah.
Exocarpus cupressiformis	Native Cherry.
E. latifolius	Sydney Cherry.
Melaleuca Smithii	Tea Tree.
Callistemon lanceolatus	Bottle Brush.
Monotoca elliptica.	Pigeon Berry Ash.

24. INTERIOR FITTINGS.

Eucalyptus obliqua, and other species	Stringybark.
E. Delegatensis...	Mountain Ash.
E. maculata	Spotted Gum.
E. marginata	Jarrah
E. saligna	Sydney Blue Gum
Castanospermum australe	Black Bean.
Acacia melanoxylon	Blackwood.
A. salicina	Eumung.
Grevillea spp., Orites, and most Proteaceous timbers	*Silky Oaks.
Casuarina spp.	Shee Oaks.
Pentaceras australis	Scrub Hickory.
Alphitonia excelsa	*Red Ash.
Callitris glauca, and C. calcarata ...	*Cypress Pines.
Cedrela Toona	*Cedar.
Dysoxylon Muelleri	*Red Bean.

25. JOINERY WORK.

(See "Interior Fittings" and 'Framing.")

26. MALLETS.

Eucalyptus longicornis	Morrell.
Tristania conferta, T. laurina	Brush Box; Water Gum.
Harpullia pendula	Tulip Wood.
Avicennia officinalis	Grey Mangrove.
Weinmannia lachnocarpa	Marari e.
Callistemon lanceolatus, C. salignus ...	Bottle Brush.

27. MAULS.

Ironbark and Box spp.

28. MILLING.

All the species of hardwood mentioned in this work, and species listed in "Cabinet Timbers of Australia," by R. T. Baker.

29. MINING.

(See article under 'Mining.")

30. NAVES.

(See article under "Coachbuilding.")

31. OARS.

Eucalyptus Delegatensis	Mountain Ash.
E. viminalis	Ribbony Gum.
E. rubida	Mountain Gum.

32. PARQUETRY.

For the large patterns almost any of our hardwoods are suitable and, having a diversity of colour, some very artistic effects can be produced.

33. PAVING. (Road Wood-blocks.)

Eucalyptus hardwoods generally, excepting Spotted Gum (*E. maculata*).

* Softwoods.

34. PLANES.

Monotoca elliptica	Native Beech.
Weinmannia lachnocarpa	Mararie.
Villaresia Moorei	N.S.W. Maple.
Melaleuca Maideni, and M. Smithii ...	Tea Trees.
Trococarpa laurina	Brush Cherry.
Grevillea striata	Beefwood.
Backhousia sciadophora	Myrtle.
B. myrtifolia	Grey Myrtle.

(See under "Substitutes for Exotic Timbers.")

35. POSTS.

Most hardwoods are used for this purpose, but perhaps the most durable are the Ironbarks, Blackbutts, White Mahogany, White Stringybark, Bloodwoods, Jarrah, Karri, Turpentine, Water Gum, Tuart, and Tea Trees. (See also "Fencing.")

36. RAILS.

Almost any of the hardwoods are suitable for this purpose, preference being given to the more fissile for obvious reasons.

37. SCANTLINGS.

Any of the Eucalyptus species are used for this.

38. SCREWS.

Sideroxylon australe	Black Apple.
Monotoca elliptica	Native Beech.
Casuarina Cambagei	Belah.
Pittosporum undulatum...	Pittosporum.
Tristania laurina	Water Gum.
Backhousia myrtifolia	Grey Myrtle.

(See under Box in article on "Substitutes for Exotic Timbers.")

39. SHAFTS.

(Light.)

Eucalyptus maculata	Spotted Gum.
E. fraxinoides, E. Delegatensis	Mountain Ash.
E. regnans	Giant Gum.
E. viminalis.	Manna or Ribbony Gum.
E. diversicolor	Karri.
E. gomphocephala	Tuart.
E. cornuta	Yate.
E. longicornis	Morrell.
Flindersia Oxleyana	Long Jack.

(Heavy.)

Eucalyptus microcorys	Tallow-wood.
E. spp.	Ironbark.

40. SHEAVES FOR BLOCKS.

Flindersia australis	Teak.
Acacia pendula	Myall.
A. excelsa	Ironwood.
A. homalophylla	Yarran.
A. harpophylla	Brigalow.
A. penninervis	Mountain Hickory.
A. Cambagei...	Gidgee.
Trist nia laurina	Water Gum.
Ventilago viminalis	Supple Jack.
Geijera Muelleri	Axe-breaker.
Weinmannia lachnocarpa	Mararie.
Casuarina Cambagei	Belah
Harpullia pendula	Tulip Wood.
Bosistoa sapindiformis	Union Nut.
Randia densiflora	
Eucalyptus Thozetiana	Australian Lignum-vitæ.
Exocarpus cupressiformis	Native Cherry.
E. latifolius	Sydney Cherry.

41. SHINGLES.

The timbers used in the past have been hardwoods, such as :—

Casuarinas, any species...	Shee Oaks.
Eucalyptus spp.	Ironbarks.

42. SHIP-BUILDING.

In general construction, except outside planking, hardwoods mostly found on the markets have been utilised.

Those used for specific purposes are given in general article under Ship building.

43. SLEEPERS.

In the eastern States Ironbark for preference, but owing to the great depletion of the forests for this purpose other hardwoods have been utilised.

In Western Australia, Jarrah (*E. marginata*) is the favourite timber for this purpose.

44. SPOKES.

(Light.)

Eucalyptus maculata	Spotted Gum.
E. viminalis	Ribbon Gum.
E. rubida	Candle Bark.
E. fraxinoides, E. Delegatensis, E. regnans, E. oreades	Mountain Ashes.
E. engenioides, E. Wilkinsoniana	Stringybarks.
E. diversicolor	Karri.
E. loxophleba	York Gum
E. cornuta	Yate.

(Heavy.)

Eucalyptus microcorys	Tallow-wood
E. spp.	Ironbark.
E. gomphocephala	Tuart.
E. redunca	Wandoo.

45. TELEGRAPH POLES.

(See article under this heading.)

46. TRENAILS.

(See under "Ship-building.")

47. TURNERY.

Almost any of the hardwoods are used in this industry.

48. VENEERS.

Any woods, of course, can be used for this purpose, but those possessing the most attractive figure are selected. The following are the most suitable —

Cryptocarya Palmerstoni	Queensland Walnut.
Zanthoxylum brachyacanthum ...	Thorny Yellow wood.
Harpullia pendula	Tulip Wood.
Rhodosphæra rhodanthema	Yellow Cedar.
Eremophila Mitchelli	Budda or Sandalwood.
Castanospermum australe	Black Bean
Acacia pendula	Myall.
A. melanoxylon	Blackwood.
A. homalophylla	Yarran.
A. excelsa	Ironwood.
A. Bakeri	Hickory.
A. salicina	Eumung.
Tarrietia argyrodendron	Crowsfoot Elm.
Banksia serrata	*Red Honeysuckle.
B. integrifolia	*White Honeysuckle.
Melaleuca Smithii	Tea Tree.
Ratonia tenax	Brush Teak.
Eucalyptus Delegatensis	Mountain Ash
E. obliqua	Tasmanian Oak.
E. marginata	Jarrah.
Grevillea striata, and almost any of the Proteaceæ	Beefwood.

*Softwoods

49. WALKING STICKS.

Timbers with and without figure may be used for this purpose.

Figured.

Casuarina spp	Shee Oaks.
Grevilleas, and any of the Proteaceæ ...	*Silky Oaks.

Acacias possessing the figure known as ringed are in great request, especially Ringed Gidgee (*A Cambagei*). Spotted Gum and other Eucalypts are often found with this figure, and make fine sticks.

Plain.

Stringybarks, dark and pale-coloured, and Acacias would be used in this connection.

50. WEATHERBOARDS.

Most hardwoods of the Eucalyptus species are used for this purpose, but for decorative material the red are preferred, such as Jarrah, Red Mahogany, Sydney Blue Gum.

51. WHARVES.

Piles, &c.

(See article on this subject.)

Decking.

Eucalyptus marginata	Jarrah.
E, diversicolor	Karri.
Tristania conferta	Brush Box.
Eucalyptus Muelleriana	Yellow Stringybark.

52. WHEELWRIGHTS' WORK.

Felloes.

(See under Felloes.)

Hubs.

(See also under Naves.)

Eucalyptus maculata	Spotted Gum.
E. spp.	Ironbark.
E. microcorys	Tallow-wood.
Avicennia officinalis	Grey Mangrove.

Spokes.

(See Spokes.)

Naves.

(See under Naves.)

53. WINE CASKS.

(See under Cooperage.)

Grevillea robusta	*Silky Oak.
Acacia melanoxylon	Blackwood.
Eucalyptus Delegatensis, E. fraxinoides, E oreades	Mountain Ashes

* Softwoods.

FIG. CXCIV

Black Apple (*Sideroxylon australe*).

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ADDENDUM.

OMITTED FROM PAGE 120.

Callicoma serratifolia, Andr.

"BLACK WATTLE." Plate 30.

TIMBER.

DESCRIPTION AND USES.

This tree yields a rather fine timber, falling in the medium class of hardwoods, the colour somewhat resembling *Ceratopetalum apetalum*, but the facies is not unlike English Beech, or perhaps more closely resembling Canadian Maple or Sycamore.

It is rather straight in the grain with a small radial figure which gives the timber a neat appearance when polished; is rather tough to plane although a good coach and carriage wood, and well suited for cabinet work and allied trades.

H. = Moderate. W. = 44 lb. per cubic foot.

Systematic.

This species grows to a medium-sized tree, the young shoots often tomentose or villous, the branches soon glabrous. Leaves from elliptical-oblong to ovate-lanceolate, shortly acuminate, coarsely serrate, 2 to 4 inches long, coriaceous, glabrous and shining above, either white underneath with a minute tomentum, or softly tomentose or villous and more rust-coloured, the parallel pinnate veins prominent underneath. Stipules ovate, very deciduous. Flowers numerous, in dense globular heads on peduncles of ½ to 1 inch, of which two to four are usually on a short panicle.

Geographical Range.

The Coastal districts of New South Wales and Queensland.

58699—2 I

SYSTEMATIC LIST.

Scientific Name.	Common Name.	Plate.	Figure.
CAPPARIDEÆ.			
Capparis nobilis, F.v.M.	Native Orange	1	
C. Mitchelli, F.v.M.	Native Pomegranate		
BIXINEÆ (Flacourtieæ).			
Scolopia Brownii, F.v.M.	Mountain Cherry	2	
PITTOSPOREÆ.			
Pittosporum rhombifolium, A. Cunn.	White Holly		
P. undulatum, Andr.	White Holly	3	XX
P. ferrugineum, Ait.			
Hymenosporum flavum, F.v.M.	Wollum Wollum		
Bursaria spinosa, Cav.	Box Thorn		
STERCULIACEÆ.			
Tarrietia argyrodendron, F.v.M.	Crow's-foot Elm	4	XXI
T. ,, ,, var. trifoliolata; var. peralata			
T. actinophylla, Bail.	Ironwood		
Heritiera littoralis, Ait.	Red Mangrove		
TILIACEÆ.			
Elæocarpus obovatus, D. Don.	Whitewood		
E. Bancroftii, F.v.M.	Ebony Heart of Cairns		
RUTACEÆ.			
Bosistoa sapindiformis, F.v.M.	Union Nut		
B. euodiformis			XXII
Bouchardatia neurococca, Bail.			
Melicope erythrococca, Bail.			
M. australasica, F.v.M.	Soapwood		
Evodia micrococca, F.v.M.	Whitewood		
E. xanthoxyloides, F.v.M.			
Geijera salicifolia, Schott.	Lignum-vitæ or Ironwood	5	
G. Muelleri, Benth.	Axe-breaker	6	
G. parviflora, Lindl.	Wilga		
Xanthoxylon brachyacanthum, F.v.M.	Thorny Yellow-wood	7	
X. veneficum, Bail.	Poison Tree		
Medicosma Cunninghamii, Hook.f.	Glue Gum		
Pentaceras australis, Hook.f.	Scrub Hickory	8	XXIII
Acronychia Baueri, Schott.	Yellow-wood		
A. lævis, Forst.			
A. imperforata, F.v.M.	Fraser Island Apple		
A. melicopoides, F.v.M.			
Halfordia drupifera, F.v.M.			
H. scleroxyla, F.v.M.	Kerosene Tree		
SIMARUBEÆ.			
Cadellia monostylis, Benth.	Black Plum	9	
C. pentastylis, F.v.M.	Redwood		
OLACINEÆ.			
Villaresia Moorei, F.v.M.	New South Wales Maple	10	XXIV
MELIACEÆ.			
Amoora nitidula, Benth.			
Flindersia australis, R.Br.	Teak	11	XXV
F. Oxleyana, F.v.M.	Long Jack, Yellow-wood, Mountain Ash.	12	
F. Bennettiana, F.v.M.	She Teak		
F. maculosa, Lindl.	Leopard Tree		
F. Iffliana, F.v.M.	Cairn's Hickory	13	

SYSTEMATIC LIST—*continued.*

Scientific Name.	Common Name.	Plate	Figure.
CELASTRINEÆ.			
Celastrus dispermus, F.v.M.	Yellow Bark	14	
Denhamia obscura, Meisn.			
D. pittosporoides, F.v.M.			
Siphonodon australe, Benth.	Native Guava or Ivory-wood		
RHAMNEÆ.			
Ventilago viminalis, Hk.	Supple Jack	15	
Alphitonia excelsa, Reiss.	Red Ash	16	XXVI
Emmenospermum alphitonioides, F.v.M.	Greenheart or Bonewood		XXVII
SAPINDACEÆ.			
Ratonia pyriformis, Benth.	Brush Apple		
R. anadonta, F.v.M.			
R. stipitata, Benth.			
R. tenax, Benth.	Brush Teak	17	XXVIII
Harpullia pendula, Planch.	Tulip-wood	18	
Cupania anacardioides, A. Rich.	Tuckeroo		
C. tomentella, F.v.M.			
C. pseudorrhus, A. Rich.	Fern Tree		
C. nervosa, F.v.M.	Beetroot	19	
Nephelium semiglaucum, F.v.M.	Wild Quince		
N. tomentosum, F.v.M.			
N. foveolatum, F.v.M.		20	
N. leiocarpum, F.v.M.			
N. Lauterianum			
Diploglottis Cunninghamii, Hk.	Tamarind	21	
Castanospora Alphandi, F.v.M.			
Atalaya hemiglauca, F.v.M.	White-wood		
Heterodendron oleæfolium, Desf.			
ANACARDIACEÆ.			
Rhodosphæra rhodanthema, Engl.	Yellow Cedar	22	XXIX
Semecarpus australiensis, Linn.			
Plieogynium Solandri, Engl.	Sweet Plum		
LEGUMINOSÆ.			
Castanospermum australe, A. Cunn.	Black Bean or Moreton Bay Chestnut.	23 24	XXX
Barklya syringifolia, F.v.M.			
Cassia Brewsteri, F.v.M.	Cigar Tree		
Bauhinia Hookeri, F.v.M.			
B. Carronii, F.v.M.	Pegunny		
Afzelia australis, Bail.	Johnstone River Teak		
Cynometra ramiflora, F.v.M.			
Acacia salicina, Lindl.	Eumung	25	
A. penninervis, Sieb.	Mountain Hickory		
A. Bakeri, J.H.M.	Hickory	26*a*	
A. binervata, DC.	Twin-veined Hickory		
A. homalophylla, A. Cunn.	Yarran		
A. implexa, Benth.	Hickory		
A. harpophylla, F.v.M.	Brigalow	26	
A. excelsa, Benth.	Eumung or Ironwood		
A. melanoxylon, R. Br.	Blackwood	26*b*	
A. pendula, A. Cunn.	Myall	27	XXXI
A. Cambagei, R.T.B.	Ring Gidgee	28	
A. longifolia, Willd.	Sydney Golden Wattle		
A. doratoxylon, A. Cunn.	Spearwood or Hickory		
A. Maideni, F.v.M.	Sally or Scrub Hickory		
A. glaucescens, Willd.			
A. acuminata, Benth	Raspberry Jam		
A. aulacocarpa, A. Cunn.	Brush Ironbark		
A. Arundelliana, Bail.			
A. decurrens, Willd.			
A. fasiculifera F.v.M.			
A. neriifolia, A.Cunn.	Mock Myall		
A. stenophylla, A. Cunn.			
A. complanata, A. Cunn.			
A. aneura, F.v.M.			
A. torulosa, Benth.			
A. Cunninghamii, Hook.			

SYSTEMATIC LIST—*continued.*

Scientific Name.	Common Name.	Plate.	Figure.
ROSACEÆ.			
E cryphia Billardieri, Spach	Leather-wood		
SAXIFRAGEÆ.			
Weinmannia lachnocarpa, F.v.M.	Mararie	29	XXXII
Callicoma serratifolia, Andr.	Black Wattle	30	
COMBRETACEÆ.			
Terminalia platyptera, F.v.M.			
T. oblongata, F.v.M.			
T. bursarina, F.v.M.			
T. porphyocarpa, F.v.M.			
T. seriocarpa, F.v.M.			
MYRTACEÆ.			
Leptospermum flavescens, Sm.	Tea Tree		
L. abnorme, F.v.M.	,,		
L. myrtifolium, Sieb.	,,		
L. Wooroonooran Bail.	,,		
L. lanigerum, Sm.	,,		
L. lævigatum, F.v.M.	,,		
Callistemon lanceolatus, DC.	Bottle Brush		
C. salignus, DC.			
C. viminalis, Cheel.			
Melaleuca leucadendron, Linn.	Tea Tree		
M. Maideni, R.T.B.	Broad-leaved Tree Tea	31	
M. Smithii, R.T.B.	,, ,,		XXXIII
M. linariifolia, Sm.	Tea Tree		
M. symphyocarpa, F.v.M.	,,		
M. pauciflora, Turcz.	,,		
M. squarrosa, Don.	,,		
M. genestifolia, Sm.	,,		
M. styphelioides, Sm.	,,		
M. Preissiana, Schau.	,,		
M. ericifolia, Sm.	,,		
Angophora subvelutina, F.v.M.	Apple Tree		
A. intermedia, DC.	,,		
A. lanceolata, Cav.	Red Gum	32	XXXIV
A. Bakeri, C. Hall	Apple Tree		
A. melanoxylon, R.T.B.	Coolabah or Apple Tree		
A. ochrophylla, R.T.B.	Apple Tree		
EUCALYPTUS SPECIES.			
Bloodwoods.			
Eucalyptus tessellaris, F.v.M.	Bloodwood		
E. calophylla, R.Br.	,,	33	
E. corymbosa, Sm.	,,	34	XXXV
		Bark 34A	
E. intermedia, R.T.B.	,,	35	
E. trachyphloia, F.v.M.	,,		
E. terminalis, F.v.M.	,,		
E. eximia, Schau.	Mountain Bloodwood		
E. Abergiana, F.v.M.			
Mahoganies (White).			
Eucalyptus acmenioides, Schau.	White Mahogany	36	
E. umbra, R.T.B.	,, ,,	37	
Mahoganies (Red)			
Eucalyptus botryoides, Sm.	Bangalay		XXXVI
E. diversicolor, F.v.M.	Karri	38	
E. robusta, Sm.	Swamp Mahogany		XXXVII
E. marginata, Sm.	Jarrah	39 & 40	XXXVIII
E. patentinervis, R.T.B.	Mohagany	41	
E. hemilampra, F.v.M.	,,		
E. pellita, F.v.M.			
E. longifolia, Link et Otto	(*See also* Woollybutts)	42	
E. resinifera, Sm.		43 & 44	XXXIX
		Bark 44A	
Boxes. (Pale)			
Eucalyptus albens, Miq.	White Box		XL
E. Bridgesiana, R.T.B.	Woollybutt or Butt Butt.		XLI
E. angophoroides, R.T.B.	Apple-top Box	45	

SYSTEMATIC LIST—*continued.*

Scientific Name.	Common Name.	Plate.	Figure.
EUCALYPTUS SPECIES—*continued.*			
Boxes. (Pale)—*continued.*			
Eucalyptus Boormani, H.D. et J.H.M.	Black Box		
E. Fletcheri, R.T.B.	Lignum vitæ or River Box	46	
E. conica, H.D. et J.H.M.	Box		
E. gomphocephala, DC.	Tuart	47	
E. hemiphloia, F.v.M.	White Box	48 Bark 48A	
E. quadrangulata, H.D. et J.H.M.	Grey Box		
E. Raveretiana, F.v.M.	Iron Gum Tree		
E. melliodora, A. Cunn.	Yellow Box	49	XLII
E. bicolor, A. Cunn.	Flooded Box		
E. Stoneana, Bailey	Gum Leaf		
E. Woollsiana, R.T.B.	Mallee Box	50	
E. odorata, Behr.	,,		
Boxes (Red)			
Eucalyptus Bosistoana, F.v.M.	Red Box		
E. largiflorens, F.v.M.	,,		
E. microtheca, F.v.M.	Coolabah		XLIII
E. polyanthemos, Schau.	Red Box	51	XLIV
E. Rudderi, Maiden	Coast Red Box	52	XLV
E. populifolia, Hook.f.	Bimbil or Poplar-leaved Box		
E. hybrida, J.H.M.			
E. affinis, H.D. et J.H.M.	Ironbark Box		
E. Brownii, J.H.M. et R.H.C.	Box Tree		
Tallow-woods.			
Eucalyptus microcorys, F.v.M.	Tallow-wood	53 Bark 53A	XLVI
E. Planchoniana, F.v.M.	,,		
Stringybarks.			
Eucalyptus Baileyana, F.v.M.			
E. campanulata, R.T.B. et H.G.S.	New England Stringybark		
E. capitellata, Sm.	Brown Stringybark	54	
E. carnea, R.T.B.	North Coast Stringybark		XLVII
E. dextropinea, R.T.B.	Stringybark	55	XLVIII
E. eugenioides, Sieb.	White Stringybark	56 Bark 56A	XLIX
E. Guilfoylei, J.H.M.	Stringybark		
E. fastigata, H.D. et J.H.M.	,,	57	
E. lævopineæ, R.T.B.	Silver-top Stringybark	58	
E. macrorhyncha, F.v.M.	Red Stringybark	59	
E. Cannoni, sp. nov.	,,		
E. Muelleriana, A.W.H.	Yellow Stringybark	60	
E. obliqua, L'Her.	Messmate	61, 62	
E. Stuartiana, F.v.M.	Victorian Apple		
E. Jacksoni, J.H.M.	Stringybark		
E. Wilkinsoniana, R.T.B.	Small-leaved Stringybark		
Woollybutts.			
Eucalyptus longifolia, Link. et Otto (*See* Mahoganies)	Woollybutt or Peppermint	42	
E. Macarthuri, H.D. et J.H.M.	Camden Woollybutt		
Blackbutts.			
Eucalyptus pilularis, Sm.	Blackbutt	63, 64	L
E. Cambageana, J.H.M.	,,		
E. Clelandi, J.H.M.	,,		
E. patens, Benth.	,,	65	
E. Dundasi, J.H.M.	,,		
Gums. (Pale.)			
Eucalyptus acervula, Hook.f.	Red Gum of Tasmania	66	
E. Banksii, J.H.M.	Gum		
E. citriodora, Hook.f.	Citron-scented Gum		
E. corynocalyx, F.v.M.	Sugar Gum		
E. Dunnii, J.H.M.	White Gum		
E. Griffithsii, J.H.M.			
E. globulus, Labill.	Blue Gum	67	II
E. St. John', sp. nov.			
E. nitens, J.H.M.			

SYSTEMATIC LIST—*continued.*

Scientific Name.	Common Name.	Plate.	Figure.
EUCALYPTUS SPECIES—*continued.*			
Gums. (Pale)—*continued.*			
Eucalyptus goniocalyx, F.v.M.	Mountain Gum	68	
E. maculata, Hook.f.	Spotted Gum	69	LII
E. Maideni, F.v.M.	Blue Gum	70	
E. Mundijongensis, J.H.M.	Tuart		
E. ochrophloia, F.v.M.	Yapungah		
E. regnans, F.v.M.	Giant Gum	71	LIII
E. urnigera, Hook.f.	Red Gum	72	
E. viminalis, Labill.	Manna Gum	73	
E. vitrea, R.T.B.	White Top Messmate		
Gums. (Red.)			
Eucalyptus Deanei, J.H.M.	Broad-leaved Blue Gum	74	
E. dealbata, A. Cunn.	Mountain or Inland Red Gum		
E. Parramattensis, C. Hall	White Gum		
E. Dawsoni, R.T.B.	Slaty Gum	75	LIV
E. Behriana, F.v.M.	Red Gum		
E. cornuta, Labill.	Yate Gum	76	
E. Thozetiana, F.v.M.			
E. leucoxylon, F.v.M.	Blue Gum	77	
E. longicornis, F.v.M.	Morrell		
E. intertexta, R.T.B.	Coolabah		
E. loxophleba, Benth.	York Gum	78	
E. occidentalis, Endl.	Flat-topped Yate		
E. propinqua, H.D. et J.H.M.	Grey Gum (North Coast)	79	
E. punctata, DC.	Grey Gum	80	
E. redunca, Schau	Wandoo	81	
E. rubida, H.D. et J.H.M.	Candle Bark		
E. Seeana, J.H.M.			
E. salmonophloia, F.v.M.	Salmon Gum	82	LV
E. rostrata, Schl.	Murray Red Gum	83, 84	LVI
E. Torrelliana, F.v.M.			
E. salubris, F.v.M.			
E. saligna, Sm.	Sydney Blue Gum	85, 86 Bark 86A	LVII
E. saligna, var. pallidivalvis, R.T.B. et H.G.S.	Flooded Gum		
E. tereticornis, Sm.	Forest Red Gum	87	
E. squamosa, H.D. et J.H.M.	Ironwood		
E. maculosa, R.T.B.	Mountain Spotted Gum		
E. ovalifolia, R.T.B.	Red Gum		
E. ovalifolia, var. lanceolata, R.T.B. et H.G.S.			
E. fasciculosa, F.v.M.	Pink Gum	88	
E. Le Souefii, J.H.M.			
E. Benthami, J.H.M. et R.H.C.	Flooded Gum		
Peppermints.			
Eucalyptus amygdalina, Labill.	Tasmanian Black Peppermint		
E. Australiana, R.T.B. et H.G.S.	Narrow-leaved Peppermint	89 Bark 89A	LVIII
E. piperita, Sm.	Sydney Peppermint	90	LIX
E. linearis, Dehn.	White Peppermint		
E. Andrewsi, J.H.M.	New England Peppermint		
E. Penrithensis, J.H.M.	Peppermint		
Mountain Ashes.			
E. Delegatensis, R.T.B.	Mountian Ash	91	LX
E. Consideniana, J.H.M.	White Ash		
E. fraxinioides, H.D. et J.H.M.	,,	92	LXI
E. virgata, Sieb.	Ironbark of Tasmania	93	
E. oreades, R.T.B.	Smooth Bark Mountain Ash.	94	LXII
E. Smithii, R.T.B.	Gully Ash		
E. Sieberiana, F.v.M.	Mountain Ash	95	
Ironbarks.			
Eucalyptus Fergusoni, R.T.B.	Bloodwood Ironbark	96	LXIII
E. crebra, F.v.M.	Narrow-leaved Ironbark	97 Bark 97A	
E. siderophloia, Benth.	Broad-leaved Ironbark	98	LXIV
E. sideroxylon, A. Cunn.	A Red Ironbark		
E. Caleyi, J.H.M.	Broad-leaved Ironbark		

SYSTEMATIC LIST—*continued.*

Scientific Name.	Common Name.	Plate.	Figure.
EUCALYPTUS SPECIES—*continued.*			
Ironbarks—*continued.*			
Eucalyptus melanophloia, F.v.M.	Silver-leaved Ironbark		
E. Staigeriana, Bail.	Lemon-scented Ironbark		
E. Nanglei, R.T.B.	Pink Ironbark	99	LXV
E. paniculata, Sm.	White, Black or Grey Ironbark	100	LXVI
E. Beyeri, R.T.B.	Narrow-leaved Ironbark	101	
E. drepanophylla, F.v.M.			
Tristania neriifolia, R.Br.	Water Gum		
T. suaveolens, Sm.	Water Gum or Swamp Turpentine.		
T. conferta, R.Br.	Brush Box	102	LXVII
T. laurina, R.Br.	Water Gum	103	
Syncarpia laurifolia, Ten.	Turpentine	104	
		Bark 104A	
S. leptopetala, F.v.M.	Brush Turpentine		
S. Hillii, Bail.	Turpentine		
Xanthostemon pachyspermus, F.v.M. et Bail.	Yellow-wood, Johnston River		
X. oppositifolius, Bail.	Southern Penda	105	
X. pubescens, C. T. White	Atherton Penda		
Backhousia myrtifolia, Hook. et Harv.	Grey Myrtle	106	
B. sciadophora, F.v.M.	Mrytle		LXVIII
B. citriodora, F.v.M.	Lemon-scented Myrtle		
B. Bancrofti, Bail. et F.v.M.	Johnstone River Hardwood		
Rhodomyrtus psidioides, Benth.			
Rhodamnia argentea, Benth.	Silver Myrtle		
Eugenia Smithii, Poir.	Lilly Pilly		
E. Wilsoni, F.v.M.			
E. Coolminiana, C. Moore	Coolamon	107	
RUBIACEÆ.			
Psychotria nematopoda, F.v.M.	Yellow Hickory		
Canthium coprosmoides, F.v.M.			
C. lucidum, Hook.f. et Arn.			
Ixora Beckleri, Benth.	Birdseye		
I. Timorensis, Benth.			
Randia densiflora, Benth.			
R. Fitzalani, F.v.M.			
EPACRIDEÆ.			
Monotoca elliptica, R.Br.	A Beech or Pigeon Berry		
Trochocarpa laurina, R.Br.	Brush Cherry		
MYRSINEÆ.			
Myrsine variablis, R.Br.			
Ardisia racemosa, R.T.B.			
SAPOTACEÆ.			
Chrysophyllum pruniferum, F.v.M.			
Sideroxylon (Achras) Pohlmanianum, F.v.M.	Black Apple		
S. laurifolium, F.v.M.			
S. australe, Benth. et Hook.f.	Black Apple	108	LXIX
S. argentum, Spreng.			
EBENACEÆ.			
Diospyros pentamera, F.v.M.	Grey Plum	109	LXX
D. Cargillea, F.v.M.	Black Plum		
Maba fasciculosa, F.v.M.			
M. reticulata, R.Br.			
M. germinata, R.Br.			
M. humilis, R.Br.			
STYRACEÆ.			
Symplocos spicata, Roxb.	A Maple		
S. Thwaitesii, F.v.M.			
OLEACEÆ.			
Olea paniculata, R. Br.	Clove Berry or Marble Wood		
Notelæa ligustrina, Vent.	Silkwood		
N. ovata, R. Br.			
N. longifolia, Vent.	Native Olive		
N. microcarpa, R. Br.			

SYSTEMATIC LIST—*continued.*

Scientific Name.	Common Name.	Plate.	Figure.
APOCYNEÆ.			
Ochrosia Moorei, F.v.M.	.....		
LOGANIACEÆ.			
Strychnos arborea, A. W. Hill	.....		LXXI
S. lucida, R. Br.	.....		
MYOPORINEÆ.			
Eremophila Mitchelli, Benth.	Budda or Sandalwood	110	LXXII
E. longifolia, F.v.M.	Emu Bush		
VERBENACEÆ.			
Avicennia officinalis, Linn.	Grey Mangrove		LXXIII & LXXIV
Vitex Lignum-vitæ, A. Cunn.	Lignum vitæ		
MONIMIACEÆ.			
Daphnandra micrantha, Benth.	Yellow Wood		
D. repandula, F.v.M.	.....		
Mollinedia Huegeliana, Tul.	.....		
LAURINEÆ.			
Cryptocarya Murrayi, F.v.M.	.....		
C. Mackinnoniana, F.v.M.	.....		
C. patentinervis, F.v.M.	.....		
C. obovata, R. Br.	Sycamore		
C. glaucescens, R. Br.	Black Beech or Black Sassafras		LXXV
C. triplinervis, R. Br.	.....		
C. Palmerstoni, Bail.	Queensland Walnut	111	
Beilschmiedia obtusifolia, Benth.	Bolly Gum or Pomatum Wood		
Endiandra glauca, R. Br.	.....		
E. discolor, Benth.	.....		
E. virens, F.v.M.	Swamp Rosewood		LXXVI
E. Sankeyana, Bail.	.....		
E. pubens, Meissn.	.....		
E. globosa, J.H.M. et E.B.	.....	112	
Persea Baileyana, F.v.M.	Candle Wood		
PROTEACEÆ.			
Macadamia ternifolia, F.v.M.	Queensland Nut	113	
M. prælta, Bail.	Scrub Honeysuckle		
Grevillea striata, R. Br.	Beefwood	114	
G. Hilliana, F.v.M.	Red Silky Oak		LXXVII
Hakea saligna, R. Br.	Foleywood		
H. lorea, R. Br.	A Western Cork-tree		
H. leucoptera, R. Br.	Needle-wood		
H. pedunculata, F.v.M.	.....		
Telopea oreades, F.v.M.	Victorian Waratah	115	
Stenocarpus salignus, R. Br.	Beefwood		
EUPHORBIACEÆ.			
Petalostigma quadriloculare, F.v.M.	Bitter Bark		
Phyllanthus Ferdinandi, F.v.M.	Pencil Cedar or Water Gum		
Hemicyclia australasica, Muell.	.....		
Bridelia exaltata, F.v.M.	Scrub Ironbark	116	LXXVIII
Croton phebalioides, F.v.M.	Native Cascarilla		
C. Verreauxii Baill.	.....		
Dissilaria baloghioides, F.v.M.	Red Heart	117	
Mallotus claoxyloides, Muell. et Arg.	Odour Bush		
M. Philippinensis, Muell. et Arg.	Kamala	118	LXXIX
M. discolor, F.v.M.	Yellow Kamala		
Baloghia lucida, Endl.	Brush Bloodwood	119	
Exæcaria Dallachyana, Baill.	Scrub Poison Tree		
URTICACEÆ.			
Celtis paniculata, Planch.	Investigator Tree		
Aphananthe Philippinensis, Planch.	Native Elm	120	LXXX
Pseudomorus Brunoniana, Bureau	Whale-bone Tree		
CASUARINEÆ.			
Casuarina stricta, Ait.	Mountain Oak		
C. glauca Sieb.	Swamp Oak	121	

SYSTEMATIC LIST—*continued.*

Scientific Name.	Common Name.	Plate.	Figure.
CASUARINEÆ—*continued.*			
Casuarina equisetifolia, Forst.	.....		
C. suberosa, Ott. et Dietr.	Forest Oak		
C. Cunninghamiana, Miq.	River Oak	122	
C. Fraseriana, Miq.	.....		
C. lepidophloia, F.v.M.	.....		
C. torulosa, Ait.	Forest Oak	123	LXXXI
C. Cambagei, R.T.B.	Belah	124	LXXXII
C. Luehmanni, R.T.B.	Bull Oak	125, 126	
C. inophloia, F.v.M. et Bail.	Stringybark Oak		
CUPULIFERÆ.			
Fagus Moorei, F.v.M.	Negro Head Beech		
SANTALACEÆ.			
Fusanus acuminatus, R. Br.	Quandong		
F. spicatus R.Br.	Sandalwood		
Exocarpus cupressiformis, Labill	Native Cherry		
E. latifolius, R. Br.	Broad-leaved Cherry		

COLOURED PLATES.

PLATE.		
	CAPPARIDEÆ.	
1.	*Capparis nobilis*, F.v.M.	NATIVE ORANGE.
	BIXINÆ.	
2.	*Scolopia Brownii*, F.v.M.	MOUNTAIN CHERRY.
	PITTOSPOREÆ.	
3.	*Pittosporum undulatum*, Vent.	PITTOSPORUM.
	STERCULIACEÆ.	
4.	*Tarrietia argyrodendron*, Benth.	CROW'S FOOT ELM.
	RUTACEÆ.	
5.	*Geijera salicifolia*, Schott.	IRONWOOD.
6.	*G. Muelleri*, Benth.	AXE-BREAKER.
7.	*Zanthoxylum brachyacanthum*, F.v.M.	THORNY YELLOW-WOOD.
8.	*Pentaceras australis*, J. Hook	SCRUB HICKORY.
	SIMARUBEÆ.	
9.	*Cadellia monostylis*, Benth.	BLACK PLUM.
	OLACINEÆ.	
10.	*Villaresia Moorei*, F.v.M.	N.S.W. MAPLE.
	MELIACEÆ.	
11.	*Flindersia australis*, R.Br.	TEAK.
12.	*F. Oxleyana*, F.v.M.	LONG JACK.
13.	*F. Iffliana*, F.v.M.	CAIRN'S HICKORY.
	CELASTRINEÆ.	
14.	*Celastrus dispermus*, F.v.M.	YELLOW BARK.
	RHAMNEÆ.	
15.	*Ventilago viminalis*, Hook.	SUPPLE JACK.
16.	*Alphitonia excelsa*, Reiss.	RED ASH.
	SAPINDACEÆ.	
17.	*Ratonia tenax*, Benth.	BRUSH TEAK.
18.	*Harpullia pendula*, Blanch.	TULIP WOOD.
19.	*Cupania nervosa*, F.v.M.	BEETROOT.
20.	*Nephelium foveolatum*, F.v.M.	
21.	*Diploglottis Cunninghamii*, Hook.f.	TAMARIND.
	ANACARDIACEÆ.	
22.	*Rhodosphæra rhodanthema*, Englr.	YELLOW CEDAR.
	LEGUMINOSÆ.	
23.	*Castanospermum australe*, A. Cunn.	BLACK BEAN.
24.	*C. australe*, A. Cunn.	,,
25.	*Acacia salicina*, Lindl.	EUMUNG.
26.	*A. harpophylla*, F.v.M.	BRIGALOW.
26A.	*A. Bakeri* J.H.M.	HICKORY.
26B.	*A. melanoxylon*, R.Br.	BLACKWOOD.
27.	*A. pendula*, A. Cunn.	MYALL.
28.	*A. Cambagei*, R.T.B.	RING GIDGEA.
	SAXIFRAGEÆ.	
29.	*Weinmannia lachnocarpa*, F.v.M.	MARARIE.
30.	*Callicoma serratifolia*, Andr.	BLACK WATTLE.

PLATE.			
	MYRTACEÆ.		
31.	*Melaleuca Maideni*, R.T.B.		Tea Tree.
32.	*Angophora lanceolata*, Cav.		Smooth-barked Apple.
33.	*Eucalyptus calophylla*, R.Br.		Red Gum.
34.	*E.*	*corymbosa*, Sm.	Bloodwood.
34A.	*E.*	*corymbosa*, Sm.	Bark.
35.	*E.*	*intermedia*, R.T.B.	Pale Bloodwood.
36.	*E.*	*acmenioides*, Schau.	White Mahogany.
37.	*E.*	*umbra*, R.T.B.	A White Mahogany.
38.	*E.*	*diversicolor*, F.v.M.	Karri.
39.	*E.*	*marginata*, Sm.	Jarrah.
40.	*E.*	*marginata*, Sm.	,,
41.	*E.*	*patentinervis*, R.T.B.	A Mahogany.
42.	*E.*	*longifolia*, Link et Otto	Woollybutt.
43.	*E.*	*resinifera*, Sm.	Red Mahogany.
44.	*E.*	*resinifera*, Sm.	,,
44A.	*E.*	*resinifera*, Sm.	Bark.
45.	*E.*	*angophoroides*, R.T.B.	Apple-top Box.
46.	*E.*	*Fletcheri*, R.T.B.	River Box.
47.	*E.*	*gomphocephala*, DC.	Tuart.
48.	*E.*	*hemiphloia*, F.v.M.	Grey Box.
48A.	*E.*	*hemiphloia*, F.v.M.	Bark.
49.	*E.*	*melliodora*, A. Cunn.	Yellow Box.
50.	*E.*	*Woollsiana*, R.T.B.	Narrow-leaved Box.
51.	*E.*	*polyanthemos*, Schau.	A Red Box.
52.	*E.*	*Rudderi*, J.H.M.	Coast Red Box.
53.	*E.*	*microcorys*, F.v.M.	Tallow-wood.
53A.	*E.*	*microcorys*, F.v.M.	Bark.
54.	*E.*	*capitellata*, Sm.	Brown Stringybark.
55.	*E.*	*dextropinea*, R.T.B.	A Stringybark.
56.	*E.*	*eugenioides*, Sieb.	White Stringybark.
56A.	*E.*	*eugenioides*, Sieb.	Bark.
57.	*E.*	*fastigata*, H.D. & J.H.M.	Stringybark.
58.	*E.*	*lævopinea*, R.T.B.	Silver-top Stringybark.
59.	*E.*	*macrorhyncha*, F.v.M.	Red Stringybark.
60.	*E.*	*Muelleriana*, A.W.H.	Yellow Stringybark.
61.	*E.*	*obliqua*, L. Herit.	A Stringybark.
62.	*E.*	*obliqua*, L. Herit.	,,
63.	*E.*	*pilularis*, Sm.	Blackbutt.
64.	*E.*	*pilularis*, Sm.	,,
65.	*E.*	*patens*, Benth.	West Australian Blackbutt.
66.	*E.*	*acervula*, Hook.f.	Red Gum.
67.	*E.*	*globulus*, Labill.	Blue Gum (Tas.) or Eurabbie.
68.	*E.*	*goniocalyx*, F.v.M.	Mountain Gum.
69.	*E.*	*maculata*, Hook.f.	Spotted Gum.
70.	*E.*	*Maideni*, F.v.M.	Southern Blue Gum.
71.	*E.*	*regnans*, F.v.M.	Giant Gum.
72.	*E.*	*urnigera*, Hook.f.	Red Gum, Tas.
73.	*E.*	*viminalis*, Labill.	Ribbon Gum.
74.	*E.*	*Deanei*, J.H.M.	A Blue Gum.
75.	*E.*	*Dawsoni*, R.T.B.	Slaty Gum.
76.	*E.*	*cornuta*, Labill.	Yate Gum.
77.	*E.*	*leucoxylon*, F.v.M.	Blue Gum, S.A.
78.	*E.*	*loxophleba*, Benth.	York Gum.
79.	*E.*	*propinqua*, H.D. & J.H.M.	Small-fruited Grey Gum.
80.	*E.*	*punctata*, DC.	A Grey Gum.
81.	*E.*	*redunca*, Sch.	Wandoo.
82.	*E.*	*salmonophloia* F.v.M.	Salmon Gum.
83.	*E.*	*rostrata*, Sch.	Murray Red Gum.
84.	*E.*	*rostrata*, Sch.	,,
85.	*E.*	*saligna*, Sm.	Sydney Blue Gum.
86.	*E.*	*saligna*, Sm.	,,
86A.	*E.*	*saligna*, Sm.	Bark.
87.	*E.*	*tereticornis*, Sm.	Forest Red Gum.
88.	*E.*	*fasciculosa*, F.v.M.	Pink Gum.
89.	*E.*	*Australiana*, R.T.B. et H.G.S.	Narrow-leaved Peppermint.
89A.	*E.*	*Australiana*, R.T.B. et H.G.S.	Bark.
90.	*E.*	*piperita*, Sm.	Peppermint.
91.	*E.*	*Delegatensis*, R.T.B.	Southern Mountain Ash.
92.	*E.*	*fraxinoides*, H.D. & J.H.M.	White Ash.
93.	*E.*	*virgata*, Sieb.	Ironbark of Tasmania.
94.	*E.*	*oreades*, R.T.B.	Smooth-bark Mountain Ash.
95.	*E.*	*Sieberiana*, F.v.M.	Mountain Ash.
96.	*E.*	*Fergusoni*, R.T.B.	Bloodwood Ironbark.
97.	*E.*	*crebra*, F.v.M.	Narrow-leaved Ironbark.
97A.	*E.*	*crebra*, F.v.M.	Bark.
98.	*E.*	*siderophloia*, Benth.	Broad-leaved Red Ironbark.
99.	*E.*	*Nanglei*, R.T.B.	Pink Ironbark.

PLATE.		
	MYRTACÆ—*continued.*	
100.	*Eucalyptus paniculata*, Sm.	BLACK, WHITE, OR GREY IRONBARK.
101.	*E. Beyeri*, R.T.B.	CHOCOLATE-COLOURED IRONBARK.
102.	*Tristania conferta*, R.Br.	BRUSH BOX.
103.	*T. laurina*, R.Br.	WATER GUM.
104.	*Syncarpia laurifolia*, Ten.	TURPENTINE.
104A.	*S. laurifolia*, Ten.	BARK.
105.	*Xanthostemon oppositifolius*, Bail.	SOUTHERN PENDA.
106.	*Backhousia myrtifolia*, Hk. & Harv.	GREY MYRTLE.
107.	*Eugenia Coolminiana*, C.M.	COOLAMON.
	SAPOTACEÆ.	
108.	*Sideroxylon australe*, Benth. et Hook.f.	BLACK APPLE.
	EBENACEÆ.	
109.	*Diospyros pentamera*, F.v.M.	GREY PLUM.
	MYOPORINEÆ.	
110.	*Eremophila Mitchelli*, Benth.	BUDDA OR SANDAL-WOOD.
	LAURINEÆ.	
111.	*Cryptocarya Palmerstoni*, Bail.	QUEENSLAND WALNUT.
112.	*Endiandra globosa*, J.H.M. & E.B.	LARGE BLACK APPLE.
	PROTEACEÆ.	
113.	*Macadamia ternifolia*, F.v.M.	QUEENSLAND NUT.
114.	*Grevillea striata*, R.Br.	BEEFWOOD.
115.	*Telopea oreades*, F.v.M.	VICTORIAN WARATAH.
	EUPHORBIACEÆ.	
116.	*Bridelia exaltata*, F.v.M.	BRUSH IRONBARK.
117.	*Dissilaria baloghioides*, F.v.M.	RED HEART.
118.	*Mallotus Philippinensis*, Muell. Arg.	KAMALA.
119.	*Baloghia lucida*, Endl.	BRUSH BLOODWOOD.
	URTICEÆ.	
120.	*Aphananthe Philippinensis*, Planch.	NATIVE ELM.
	CASUARINEÆ.	
121.	*Casuarina glauca*, Sieb.	SWAMP OAK.
122.	*C. Cunninghamiana*, Miq.	RIVER OAK.
123.	*C. torulosa*, Ait.	FOREST OAK.
124.	*C. Cambagei*, R.T.B.	BELAH.
125.	*C. Luehmanni*, R.T.B.	BULL OAK.
126.	*C. Luehmanni*, R.T.B.	,,

LIST OF BLACK AND WHITE ILLUSTRATIONS.

PART I.

FIGURE.

I. Types of Hardness.
II. Straight-grained Timber. *Eucalyptus marginata*, Jarrah.
III. Interlocked Timber. *Eucalyptus diversicolor*, Karri.
IV. Satinwood Grain.
V. Fiddle Back Grain.
VI. Fiddle Back Grain, *Eucalyptus Delegatensis*, Southern Mountain Ash.
VII. Transverse section of Timber of *Drimys aromatica*.
VIII. Radial Section of Timber of *Drim s aromatica*, showing Tracheidal structure of timber.
IX. Hardwood Fibres.
X. Transverse section of portion of stem. *Casuarina Luehmanni*, Bull Oak.
XI. Transverse section of portion of stem. *Casuarina Cambagei*, Belah.
XII. Transverse section of wood of *Leptospermum lanigerum*.
XIII. Transverse section of wood of *Eucalyptus regnans*. Giant Gum.
XIV. Crystals.
XV. Ironbark Girders and Posts.
XVI. Forest Country. Showing natural reafforestation.
XVI. Forest Country. Showing trees of *Eucalyptus maculata*, Spotted Gum.
XVII. Brush Country.
XVIII. Littoral Timber Trees. *Avicennia officinalis*, Grey Mangrove.

PART II.

Micro-Sections.

Transverse, Radial, and Longitudinal.

XIX. *Scolopia Brownii*, Mountain Cherry.
XX. *Pittosporum undulatum*, Pittosporum.
XXI. *Tarrietia argyrodendron*, Crowsfoot Elm.
XXII. *Bosistoa euodiformis*.
XXIII. *Pentaceras australis*, Scrub Hickory.
XXIV. *Villaresia Moorei*, New South Wales Maple.
XXV. *Flindersia australis*, Teak.
XXVI. *Alphitonia excelsa*, Red Ash.
XXVII. *Emmenospermum alphitonioides*, Bone-wood.
XXVIII. *Ratonia tenax*, Brush Teak.
XXIX. *Rodosphæra rhodanthema*, Yellow Cedar.
XXX. *Castanospermum australe*, Black Bean.
XXXI. *Acacia pendula*, Myall.
XXXII. *Weinmannia lachnocarpa*, Mararie.
XXXIII. *Melaleuca Smithii*, Broad-leaved Tea Tree.
XXXIV. *Angophora lanceolata*, Smooth-barked Apple.
XXXV. *Eucalyptus corymbosa*, Bloodwood.
XXXVI. *E. botryoides*, Bangalay.
XXXVII. *E. robusta*, Swamp Mahogany.
XXXVIII. *E. marginata*, Jarrah.
XXXIX. *E. resinifera*, Mahogany.
XL. *E. albens*, White Box.
XLI. *E. Bridgesiana*, Woollybutt.
XLII. *E. melliodora*, Yellow Box.
XLIII. *E. microtheca*, Coolabah.
XLIV. *E. polyanthemos*, Red Box.
XLV. *E. Ruddeæi*, Coast Red Box.
XLVI. *E. microcorys*, Tallow-wood.
XLVII. *E. carnea*, a Stringybark.
XLVIII. *E. dextropinea*, a Stringybark.
XLIX. *E. eugenioides*, White Stringybark.
L. *E. pilularis*, Blackbutt.
LI. *E. globulus*, Tasmanian Blue Gum.
LII. *E. maculata*, Spotted Gum.
LIII. *E. regnans*, Giant Gum.
LIV. *E. Dawsoni*, Slaty Gum.

FIGURE. PART II—*continued.*

LV. *Eucalyptns salmonophloia*, Salmon Gum.
LVI. *E. rostrata*, Murray Red Gum.
LVII. *E. saligna*, Sydney Blue Gum.
LVIII. *E. Australiana*, Narrow-leaf Peppermint.
LIX. *E. piperita*, Sydney Peppermint.
LX. *E. Delegatensis*, Southern Mountain Ash.
LXI. *E. fraxinoides*, White Ash.
LXII. *E. oreades*, Smooth-barked Mountain Ash.
LXIII. *E. Fergusoni*, Bloodwood Ironbark.
LXIV. *E. siderophloia*, Broad-leaved Ironbark.
LXV. *E. Nanglei*, Pink Ironbark.
LXVI. *E. paniculata*, Grey Ironbark.
LXVII. *Tristania conferta*, Brush Box.
LXVIII. *Backhousia sciadophora*, Myrtle.
LXIX. *Sideroxylon australe*, Plum.
LXX. *Diospyros pentamera*, Grey Plum.
LXXI. *Strychnos arborea.*
LXXII. *Eremophila Mitchelli*, Budda or Sandal Wood.
LXXIII. *Avicennia officinalis*, Wood split tangentially showing disposition of fibres.
LXXIV. ,, ,, Grey Mangrove.
LXXV. *Cryptocarya glaucescens.*
LXXVI. *Endiandra virens.*
LXXVII. *Grevillea Hilliana*, Red Silky Oak.
LXXVIII. *Bridelia exaltata*, Brush Ironbark.
LXXIX. *Mallotus Philippinensis.*
LXXX. *Aphananthe Philippinensis* Native Elm.
LXXXI. *Casuarina torulosa*, Forest Oak.
LXXXII. *C. Cambagei*, Belah.

PART III.

1. Seasoning.

LXXXIII. Radial section of *E. paniculata*, see Fig. 66.
LXXXIV. Horizontal method of seasoning timber, Tasmania.
LXXXV. ,, ,, ,, H. McKenzie & Co., Limited, Sydney.
LXXXVI. First Stage Seasoning (in the log), Railway Workshops, Victoria.
LXXXVII. Second Stage Seasoning (stack in the open) Railway Workshops, Victoria.
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LXXXIX. Oblique stacking for seasoning.
XC. Triangular stacking for seasoning.
XCI. Perpendicular method of seasoning.
XCII. Seasoning by Electricity, Alcock & Co., Melbourne.
XCIII. Kiln drying, loaded truck, H. McKenzie & Co., Limited, Sydney.
XCIV. ,, exterior view of the kiln showing trucks.
XCV. ,, interior view of kiln, truck just going in.
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XCVII. ,, ,, ,, interior view.
XCVIII. ,, Erith method.
XCIX. ,, Oliver method.
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CI. Burnie Freezing Works, Tasmania.
CII. Sandgate Railway Station.
CIII. Mundubbera Railway Station.
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CVI. Weatherboard house built of Hardwood, Queensland.
CVII. Rusticated Hardwood cottage, New South Wales.
CVIII. Weatherboard Church, Victoria.
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CX. Stringybark Panels with Satinwood figure, John Danks & Co., Melbourne, Victoria.
CXI. ,, ,, Fiddleback figure, John Danks & Co., Melbourne, Victoria.
CXII. ,, Panelling, and Clock with Fiddleback figure, John Danks & Co., Melbourne, Victoria
CXIII. Blackbean Panels, Commonwealth Bank, Sydney.
CXIV. Stringybark fixtures, Panels and Floor, R. Grimwade, Melbourne.
CXV. Jarrah fittings and furniture, Western Australia.
CXVI. ,, ,, Bank, Western Australia.
CXVII. Tasmanian Stringybark fittings and furniture, Hobart.
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CXIX. Mountain Ash Door, Adelaide.
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FIGURE.

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CXXII. Stringybark, *E. obliqua*, Red Gum, *E. rostrata*, South Australia.
CXXIII. York Gum *E. loxophleba* Wardrobe, Western Australia.
CXXIV. Blackwood, *Acacia melanoxylon*, Overmantle, two Cabinet Tables, Writing Table.
CXXV. Blue Gum, *E. saligna*, Hall Stand.
CXXVI. Blackwood and Stringybark Chairs.
CXXVII. Spotted Gum, *E. maculata*, Table.

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CXXIX. Shee Oak and Ironbark Shingles, New South Wales.
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CXXXII. Ketch "Relic," built of Bloodwood, Blackbutt, Mahogany, Spotted Gum, Bangalay, Stringybark.
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CXXXIV. ,, boat, "Alto."
CXXXV. ,, luggers at Broome.
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CLII. Formalin plant. ,, ,, ,,
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